

**South Carolina
8-Hour Ozone Attainment Demonstration**

**For the Portion of York County, South Carolina Within the
Rock Hill-Fort Mill Area Transportation Study (RFATS)
Metropolitan Planning Organization (MPO)**

**Part of the
Charlotte-Gastonia-Rock Hill, NC-SC
8-Hour Ozone Nonattainment Area**

**Prepared by the
South Carolina Department of Health and Environmental Control**



Bureau of Air Quality

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SOUTH CAROLINA AIR QUALITY IMPLEMENTATION PLAN

RFATS MPO 8-HOUR OZONE ATTAINMENT DEMONSTRATION EXECUTIVE SUMMARY

I. 8-hour Ozone National Ambient Air Quality Standards

On April 30, 2004, the United States Environmental Protection Agency (EPA) designated and classified that portion of York County, South Carolina within the Rock Hill Fort Mill Area Transportation Study (RFATS) Metropolitan Planning Organization (MPO) as a moderate nonattainment area for the 8-hour ozone National Ambient Air Quality Standards (NAAQS) as part of the Charlotte-Gastonia-Rock Hill, NC-SC nonattainment area. As a result of this designation, the South Carolina Department of Health and Environmental Control (SCDHEC or Department) is required to amend the *South Carolina Air Quality Implementation Plan*, also known as the State Implementation Plan, or SIP, in accordance with the requirements of the *Clean Air Act* (CAA), as amended (42 U.S.C. 7401, *et seq.*). States involved in a multi-State ozone nonattainment area must work together to perform the appropriate modeling analyses to identify control measures that will enable the area to achieve attainment as expeditiously as practicable. Each State is responsible for its portion of the control program and will be held accountable for controls identified for implementation within its State boundaries.

II. Modeling Protocol

The modeling protocol contains an overview of the models and model configurations that were chosen for use in future year attainment demonstrations. Because the Charlotte-Gastonia-Rock Hill area has been classified moderate nonattainment with a required attainment date set for June 15, 2010, the future year emission inventory for 2009 is used for attainment demonstrations. Using EPA's guidance on ozone episode selection, 2002 is meteorologically well-suited for demonstrating future year attainment because 2002 exhibited the most number of days (38) exceeding the 0.08 ppm ozone standard and because 2002 had numerous (13) and a wide variety (several different types of scenarios) of high ozone episodes.

The models that were chosen include the Mesoscale Meteorological Model (MM5), the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system, and the Community Multiscale Air Quality (CMAQ) model. MM5 and SMOKE outputs will provide the meteorological and emissions data that will be input into the CMAQ model. After completion of all CMAQ model runs, the final output undergoes operational and diagnostic evaluations to determine model performance. While there are limitations in each of the three chosen models, each model is considered the best available for its intended use.

The modeling protocol also provides in-depth discussion on inventories of point source, area source, on-road, non-road and biogenic source emission rates. The development and implementation of quality assurance (QA) and quality control (QC) strategies is the most important step in developing these inventories. QA and QC strategies are described in addition to the process of developing emission control strategies that may be applied to demonstrate compliance.

III. Attainment Demonstration Methods and Inputs

The attainment modeling for the Charlotte-Gastonia-Rock Hill, NC-SC nonattainment area was performed in conjunction with the regional haze modeling being done by the Southeast Regional Planning Organization, Visibility Improvement State and Tribal Association of the Southeast (VISTAS) and the

fine particulate matter (PM_{2.5}) and ozone modeling being done by the Association of Southeastern Integrated Planning (ASIP).

Attainment for the Charlotte-Gastonia-Rock Hill, NC-SC nonattainment area was demonstrated through the use of a modeling system consisting of USEPA's Models-3/Community Multiscale Air Quality (CMAQ) modeling system, the Pennsylvania State University/National Center for Atmospheric Research (PSU/NCAR) Mesoscale Meteorological Model (MM5), and the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system. The CMAQ modeling system is a "one-atmosphere" photochemical air quality modeling system capable of addressing ozone, fine particulate matter, visibility, and acid deposition. The MM5 modeling system is a three-dimensional, limited-area, primitive equation, prognostic meteorological model that accurately replicates important meteorological phenomena that are used as inputs for the CMAQ air quality model. The SMOKE model is principally an emission processing system that converts emissions inventory data into formatted emission files that are used as inputs for the CMAQ air quality model.

Base year 2002 was chosen to process the typical emissions through the SMOKE emissions model, which corresponds to the same year as the historic meteorology used in the air quality model. Since the mandatory attainment date for the Charlotte-Gastonia-Rock Hill, NC-SC area is June 15, 2010, a future year of 2009 was chosen as the modeled attainment year. A comparison of the air quality modeling results between these two years is used to determine a relative reduction in future ozone, which is used in the attainment demonstration. A key step in attainment demonstration modeling is the selection of episodes to model. For this attainment demonstration, criteria set out in USEPA guidance on 8-hour ozone modeling were used to select the episodes that were used in the attainment modeling for the Charlotte-Gastonia-Rock Hill, NC-SC area. The 2002 peak ozone season was chosen to model as this episode covers several criteria listed in the USEPA guidance, including the modeling of weekends and a sufficient number of days to ensure a robust modeled attainment test. Modeling the 2002 peak ozone season will also accomplish the goal of encompassing a myriad of meteorological conditions that influence tropospheric ozone formation. A detailed discussion of the configuration and description of CMAQ, MM5, and SMOKE, as well as a discussion of the episode selection process can be found in the Modeling Protocol (Appendix D).

Another consideration for the attainment modeling was an appropriate domain for which to model. The CMAQ model was run in one-way nested grid mode, which allowed the larger outer domains to feed concentration data to the inner nested domain. A high resolution 12-km grid covering the entire VISTAS region was chosen as the horizontal domain modeling domain for this attainment modeling. The vertical structure of the modeling is primarily defined by the MM5 34 layer terrain following coordinate system that extends from the surface to the 100 mb layer. The vertical domain in the CMAQ air quality modeling was reduced to 19 layers using a layer-averaging scheme, reducing the computational cost of the simulations with only a minor effect on model performance.

IV. Model Performance Evaluation

Overall, SCDHEC believes that the model performance is well within the limits of acceptable performance established in USEPA's *Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM_{2.5}, and Regional Haze* ("Attainment Guidance"). For the most part, mean normalized bias and mean normalized gross error fall within the recommended limits for good model performance. The model appears to do a good job of capturing ozone concentrations through various episode ramp-up and clean-out cycles. There are some instances of under and over predictions. However, in most instances, the model does well in simulating the afternoon ozone peak throughout the Carolinas and produces results reliable enough for use as meteorological inputs in the Metrolina Area attainment demonstration CMAQ modeling.

V. Attainment Demonstration

The attainment demonstration is based on relative reductions of ozone rather than absolute modeling results and is only applied at grid cells near the monitors. Reviewing the modeling results of how the predicted ozone decreases in the future years and how widespread the reductions are play an important role for the State in determining if additional controls should be considered.

The air quality modeling is used in a relative sense by determining what relative reduction in ozone occurred between the baseline year (2002) and the attainment year (2009). Table 1 lists the attainment test results for the Charlotte-Gastonia-Rock Hill, NC-SC area. The first two columns are the monitoring site and the county in which the site is located. The next three columns are the modeling base year design value (DVB), the relative response factor (RRF) and the future design value (DVF). According to USEPA's guidance, areas with future design values between 0.082 and 0.087 ppm need to provide additional weight of evidence that the area will attain the 8-hour ozone NAAQS. Weight of evidence to demonstrate attainment is not required for the monitor in York County .

Executive Summary Table 1: Attainment Test Results

Monitoring Site	County	DVB (ppm) 5-year weighted 2000-2004	2009	
			RRF	DVF (ppm)
Arrowood	Mecklenburg	0.0847	0.892	0.075
County Line	Mecklenburg	0.0973	0.874	0.085
Crouse	Lincoln	0.0907	0.868	0.078
Enochville	Rowan	0.0970	0.870	0.084
Garinger (Plaza)	Mecklenburg	0.0953	0.883	0.084
Monroe	Union	0.0870	0.884	0.076
Rockwell	Rowan	0.0973	0.862	0.083
York	York, SC	0.0830	0.861	0.071

VI. Attainment of the 8-hour Ozone NAAQS by 2009

SCDHEC believes that the modeling attainment demonstration, in conjunction with the weight of evidence analyses, provides the necessary evidence that the Charlotte-Gastonia-Rock Hill, NC-SC nonattainment area will attain the NAAQS by the prescribed attainment date.

The North Carolina Division of Air Quality (NCDAQ) and South Carolina Department of Health and Environmental Control (SCDHEC) provided strong weight of evidence that the Charlotte-Gastonia-Rock Hill, NC-SC nonattainment area will attain the 8-hour ozone NAAQS by 2009. This weight of evidence included looking at alternative methods to calculate the future design values, additional metrics of air quality modeling results, air quality modeling results from other studies, positive trends in observed air quality and additional emissions reductions, and additional measures that were not included in the air quality modeling.

SECTION I. SOUTH CAROLINA AIR QUALITY IMPLEMENTATION PLAN

On April 30, 2004, the United States Environmental Protection Agency (EPA) designated and classified that portion of York County, South Carolina within the Rock Hill Fort Mill Area Transportation Study (RFATS) Metropolitan Planning Organization (MPO) as a moderate nonattainment area for the 8-hour ozone National Ambient Air Quality Standards (NAAQS) as part of the Charlotte-Gastonia-Rock Hill nonattainment area. As a result of this designation, the South Carolina Department of Health and Environmental Control (SCDHEC or Department) is required to amend the *South Carolina Air Quality Implementation Plan*, also known as the State Implementation Plan, or SIP, in accordance with the requirements of Title I, Part D - Plan Requirements for Nonattainment Areas, Subpart 1, Section 172, and Subpart 2, Section 182 of the *Clean Air Act* (CAA), as amended (42 U.S.C. 7401, *et seq.*). States involved in a multi-State ozone nonattainment area must work together to perform the appropriate modeling analyses to identify control measures that will enable the area to achieve attainment as expeditiously as practicable. Each State is responsible for its portion of the control program and will be held accountable for controls identified for implementation within its State boundaries.

A. Introduction to 8-Hour Ozone NAAQS

1. Ground-Level (Tropospheric) Ozone

Ozone is a colorless gas that occurs naturally in the atmosphere and can be found in the air we breathe. Ozone is composed of three atoms of oxygen (O₃), one more than the common oxygen molecule (O₂) we need to breathe to sustain life. The additional oxygen atom makes ozone extremely reactive. Ozone in the Earth's upper atmosphere, known as stratospheric ozone, shields the Earth from the harmful effects of the sun's ultraviolet rays. Ozone found in the atmosphere closer to the Earth's surface (tropospheric ozone) is considered a harmful air pollutant due to its adverse impacts on human health and welfare.

Tropospheric ozone is commonly referred to as ground-level ozone and sometimes called smog. Ozone is not emitted directly by the combustion of fuels. Ozone is formed in the atmosphere by the reaction of volatile organic compounds (VOC) and oxides of nitrogen (NO_x) in the presence of sunlight. These air pollutants, often referred to as ozone precursors, are emitted by many types of pollution sources, including on-road and off-road motor vehicles and engines, power plants and industrial facilities, and smaller sources, collectively referred to as area sources. Ozone is predominately a summertime air pollutant. Changing weather patterns contribute to yearly differences in ozone concentrations from region to region. Ozone and the pollutants that form ozone also can be transported into an area from pollution sources found hundreds of miles upwind.

2. Health Concerns

During the hot summer months, ground-level ozone reaches unhealthy levels in several parts of the country. Ozone has been associated with increased hospitalizations and emergency room visits, school absences, and reduced activity and productivity. Even at relatively low levels, breathing ozone can trigger a variety of health problems. Ozone can irritate the respiratory system, causing coughing, throat irritation, an uncomfortable sensation in the chest, and/or pain when breathing deeply. Ozone can worsen asthma and possibly other respiratory diseases, such as bronchitis and emphysema. When ozone levels are high, more people with asthma have attacks that require a doctor's attention or the use of additional medication. Ozone can reduce lung function and make it more difficult to breathe deeply, and breathing may become more rapid and shallow than normal, thereby limiting a person's normal activity. In addition, breathing ozone can inflame and damage the lining of the lungs, which may lead to permanent changes in lung tissue, irreversible reductions in lung function, and a lower quality of life if the

inflammation occurs repeatedly over a long time period (months, years, a lifetime). People who are particularly susceptible to the effects of ozone include children and adults who are active outdoors, people with respiratory disease, such as asthma, and people with unusual sensitivity to ozone.

3. National Ambient Air Quality Standards (NAAQS)

The CAA requires USEPA to set NAAQS for pollutants considered harmful to public health and the environment. National primary and secondary ambient air quality standards under Section 109 of the CAA are set forth in Title 40 of the Code of Federal Regulations, part 50. NAAQS are subject to revision, and additional primary and secondary standards may be promulgated as USEPA deems necessary to protect the public health and welfare. USEPA has promulgated primary and secondary NAAQS for carbon monoxide, lead, nitrogen dioxide, particulate matter, sulfur oxides, and ground level ozone. USEPA calls these pollutants "criteria" air pollutants because it regulates them by developing human health-based and/or environmentally-based criteria (science-based guidelines) for setting permissible levels. For each pollutant, a health-based or "primary" standard has been set to protect public health in general, and a welfare-based or "secondary" standard has been set to protect quality of life and the environment. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

4. 8-Hour Ozone NAAQS

In 1997, USEPA revised the NAAQS for ground-level ozone, setting the standard at 0.08 parts per million (ppm) averaged over an 8-hour period. At each ozone monitoring site, hourly average concentrations are recorded in parts per million (ppm). Running 8-hour averages are computed from the hourly ozone concentration data for each hour of the year. The daily maximum 8-hour concentration for a given calendar day is the highest of the 24 possible 8-hour average concentrations computed for that day. The standard-related summary statistic is the three-year average of the annual fourth-highest daily maximum 8-hour average ozone concentrations. The three-year average is computed using the three most recent, consecutive calendar years of monitoring data. This three-year average annual fourth-highest daily maximum 8-hour average ozone concentration is also the air quality design value for the monitoring site. A violation of the 8-hour ozone NAAQS occurs when the computed design value is greater than or equal to 0.085 ppm.

B. Nonattainment Area Designations and Classifications

1. Area Designations

On February 8, 1979, USEPA promulgated the 0.12 parts per million (ppm) 1-hour ozone standards, (44 *Federal Register* 8202). On July 18, 1997, USEPA promulgated a revised ozone standard of 0.08 ppm, measured over an 8-hour period [i.e., the 8-hour standard (62 FR 38856)]. Upon promulgation of a new or revised NAAQS, the CAA requires USEPA to designate areas as attaining or not attaining that NAAQS. On April 30, 2004, USEPA announced and promulgated designations, classifications, and boundaries for every area in the United States with respect to the 8-hour ozone NAAQS (69 FR 23857).

The 8-hour ground-level ozone NAAQS design values were calculated for each ozone monitor in the United States. The USEPA area designations were generally based on air quality monitoring data collected from 2001 to 2003. The highest monitor design value in an area was used to determine its designation. The CAA then specifies requirements for areas based on whether such areas are or are not attaining the NAAQS.

2. Nonattainment Area Boundaries

The CAA defines a nonattainment area as an area that is violating an ambient standard or is contributing to a nearby area that is violating the standard. Once it is determined that a monitor is recording a violation, the next step is to determine if there are any nearby areas that are contributing to the violation and include them in the designated nonattainment area. When evaluating the air quality factors for individual areas, USEPA took into account its view that, in most cases, data recorded by an ozone air quality monitor represents air quality throughout the area in which the monitor is located. USEPA used the county as the basic jurisdictional unit in determining the extent of the area reflected by the ozone monitor data. As a result, if an ozone monitor was violating the standard based on the 2001–2003 data, USEPA designated the entire county as nonattainment. The actual size of the nonattainment area may be larger or smaller, depending on air quality-related technical factors contained in the USEPA guidance on determining nonattainment area boundaries for the 8-hour ozone standard.

Section 107(d)(4) of the CAA established the Consolidated Metropolitan Statistical Area (CMSA) or Metropolitan Statistical Area (MSA) as the presumptive boundary for areas designated nonattainment in 1991 for violating the ozone NAAQS. Once a CMSA, MSA, or single county area was determined to contain a monitor that was violating the standard, USEPA and the State considered several factors, including emissions, population density, traffic congestion, commercial development, industrial development, meteorological conditions, and pollution transport in establishing the nonattainment area boundaries. It is necessary to evaluate all counties in and around an area containing a monitor that is violating the standard to justify including counties outside the CMSA or MSA or excluding counties in the CMSA or MSA. In some cases, in considering these factors as well as information and recommendations provided by the State, USEPA determined that only part of a county was contributing to the nearby nonattainment area.

3. Nonattainment Area Classifications

Title I, part D of the CAA contains two sets of provisions that address planning and control requirements for nonattainment areas. Subpart 1 (which is referred to as "basic" nonattainment) contains general, less prescriptive, requirements for nonattainment areas for any pollutant governed by a NAAQS, including ozone. Subpart 2 (which is referred to as "classified" nonattainment) provides more specific requirements for ozone nonattainment areas.

An area designated nonattainment for the 8-hour ozone NAAQS with a 1-hour design value less than 0.121 ppm at the time of designation is subject to the requirements of Subpart 1 and is covered under Section 172(a)(1) of the CAA. These "basic" nonattainment areas have five years from designation to attain the standard. USEPA has provided flexibility for areas that have entered into a compact and take early action to achieve emissions reductions necessary to attain the 8-hour ozone standard. This action defers the effective date of the nonattainment designation for these areas and establishes regulations governing future actions with respect to these areas. USEPA has also promulgated deferral of the effective date of the nonattainment designation for Early Action Compact areas.

8-hour ozone nonattainment areas with 1-hour design values of 0.121 ppm or greater at the time of designation are subject to the provisions of Subpart 2 and are classified in accordance with Section 181 of the CAA as marginal, moderate, serious, severe, or extreme depending on the area's 8-hour design value. Nonattainment areas with more serious ozone pollution, as differentiated by these area classifications, are subject to more control requirements as prescribed in Section 182 of the CAA. These prescribed requirements are designed to bring areas into attainment by their specified attainment dates, which are also based upon the area's classification. (See Table I-1: "Subpart 2 Classifications and Attainment

Dates.")

Table I-1: Subpart 2 Classifications and Attainment Dates

Classification	Design Value Range (ppm)	Attainment Date
Marginal	0.085 up to 0.092	June 15, 2007
Moderate	0.092 up to 0.107	June 15, 2010
Serious	0.107 up to 0.120	June 15, 2013
Severe 15	0.120 up to 0.127	June 15, 2019
Severe 17	0.127 up to 0.187	June 15, 2021
Extreme	0.187 and above	June 15, 2024

C. 8-hour Ozone Designations for South Carolina

On April 15, 2004, USEPA promulgated 8-hour ozone designations and classifications for all of the counties in South Carolina based on the design values calculated from air quality monitoring data collected during the 2001, 2002, and 2003 ozone seasons. Almost all of South Carolina was designated unclassifiable/attainment for the 8-hour ozone standard; however, the following three areas of South Carolina were designated nonattainment:

1. Greenville-Spartanburg-Anderson Area: This nonattainment area includes the entirety of Greenville, Spartanburg, and Anderson Counties. The Greenville-Spartanburg-Anderson Area was designated a Subpart 1 nonattainment area. The Greenville-Spartanburg-Anderson Area has opted to enter into an Early Action Compact and take early action to achieve emissions reductions necessary to attain the 8-hour ozone standard. USEPA has promulgated deferral of the effective date of the nonattainment designation for the Greenville-Spartanburg-Anderson Area.

2. Columbia Area: This nonattainment area includes the portions of Richland and Lexington counties within the borders of the Columbia Area Transportation Study (COATS) Metropolitan Planning Organization (MPO). The Columbia Area was designated a Subpart 1 nonattainment area. The Columbia Area has opted to enter into an Early Action Compact and take early action to achieve emissions reductions necessary to attain the 8-hour ozone standard. USEPA has promulgated deferral of the effective date of the nonattainment designation for the Columbia Area.

3. Charlotte-Gastonia-Rock Hill, NC-SC Area: The Charlotte-Gastonia-Rock Hill, NC-SC nonattainment area includes that portion of York County, South Carolina within the Rock Hill Fort Mill Area Transportation Study (RFATS) Metropolitan Planning Organization (MPO). The Charlotte-Gastonia-Rock Hill, NC-SC Area (also referred to as the Metrolina area) is classified as a Subpart 2 moderate nonattainment area.

Figure I-1, *8-hour ozone nonattainment boundaries for South Carolina*, outlines the majority of the State that was designated attainment/unclassifiable and highlights the corresponding boundaries of the three areas designated nonattainment.

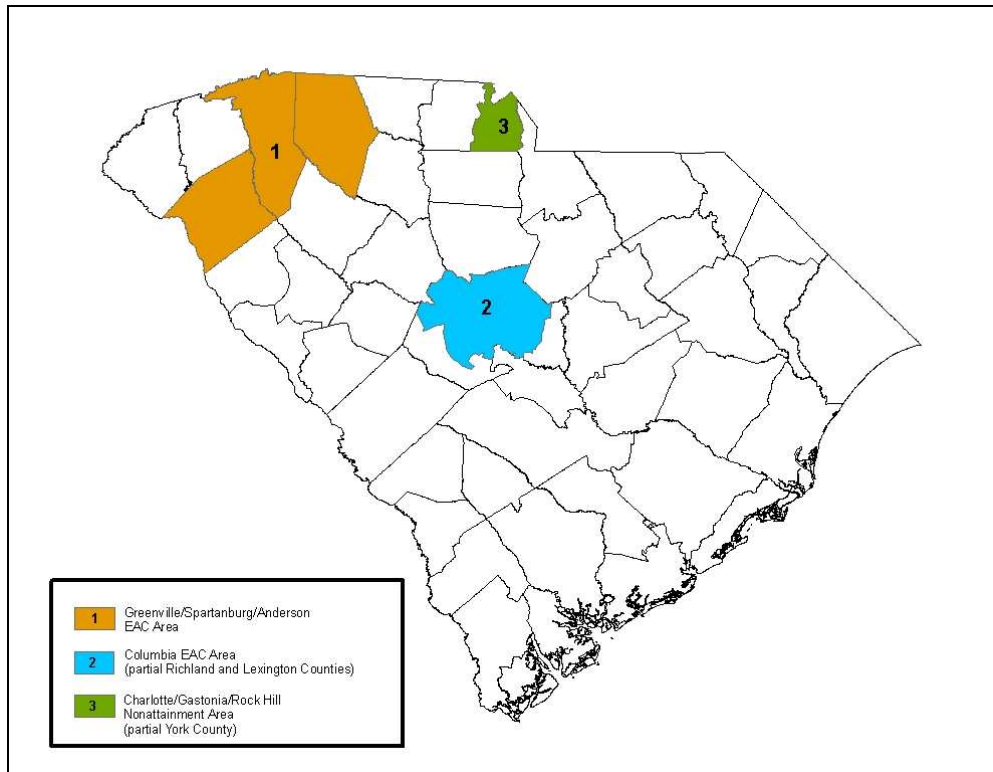


Figure I-1: 8-hour ozone nonattainment boundaries for South Carolina

D. Charlotte-Gastonia-Rock Hill, NC-SC Metropolitan Statistical Area

1. Charlotte-Gastonia-Rock Hill, NC-SC Metropolitan Statistical Area

The Charlotte-Gastonia-Rock Hill, NC-SC Metropolitan Statistical Area (MSA), as defined by the Federal Office of Management and Budget (OMB) on June 30, 1999, consists of Cabarrus, Gaston, Lincoln, Mecklenburg, Rowan, and Union Counties in NC; and York County in SC. MSA boundaries are based on city and county populations in urbanized areas, with "outlying counties" being included in the MSA contingent upon their commuting patterns into the central counties. Under OMB standards, the county (or counties) that contains the largest city becomes the "central county" (counties), along with any adjacent counties that have at least 50 percent of their populations in the urbanized area surrounding the largest city. The MSA are named according to the populations of the largest central cities. As noted previously, the CMSA or MSA is the USEPA presumptive boundary for areas designated nonattainment for violating the ozone NAAQS.

2. Monitors in the Charlotte-Gastonia-Rock Hill, NC-SC MSA

Figure I-2: "Monitors in the Charlotte-Gastonia-Rock Hill, NC-SC MSA" displays where monitors are located in the Charlotte-Gastonia-Rock Hill, NC-SC MSA. There are no ozone monitors located in either Cabarrus County or Gaston County in NC. The historic air quality data for the monitors in the Charlotte-Gastonia-Rock Hill, NC-SC MSA is listed in Appendix C.

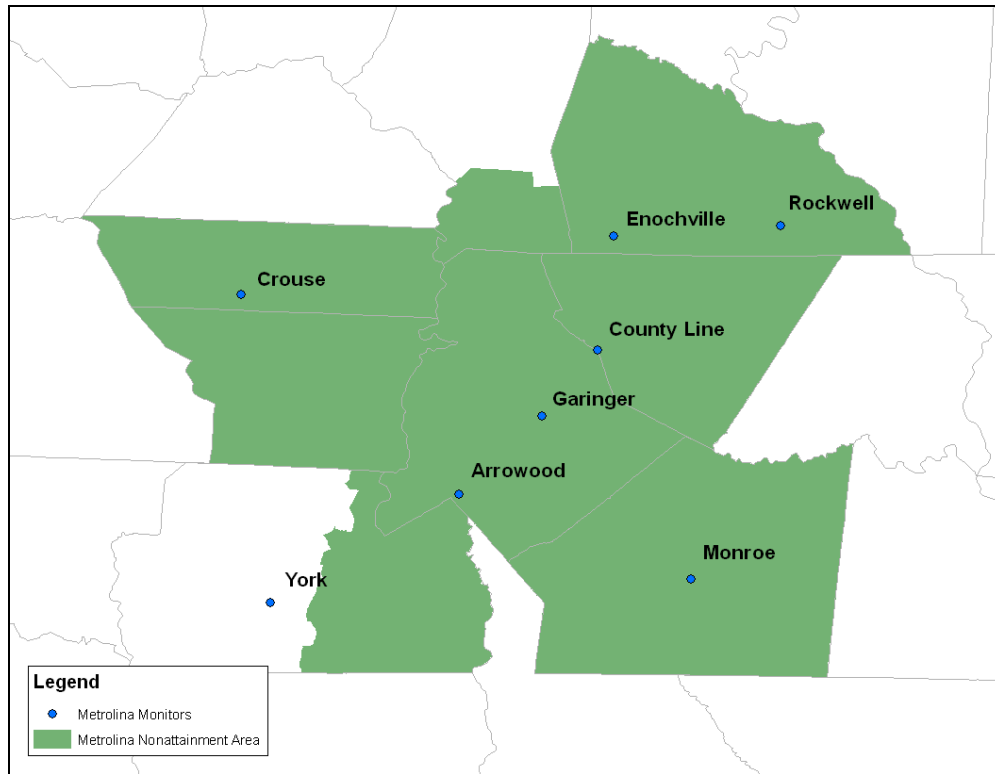


Figure I-2: Monitors in the Charlotte-Gastonia-Rock Hill, NC-SC MSA

3. 2001-2003 Design Values for Monitors Located in the MSA

Table I-2: "2001-2003 Design Values" lists the annual fourth-highest daily maximum 8-hour average ozone concentration and calculated design values for all of the monitors within the Charlotte-Gastonia-Rock Hill, NC-SC MSA.

Table I-2: "2001-2003 Design Values "

Monitor	County	4 th Highest 8-hour Ozone Value			2001-2003 Design Value
		2001	2002	2003	
Crouse	Lincoln	0.094	0.095	0.089	0.092
County Line	Mecklenburg	0.099	0.107	0.088	0.098
Garinger (Plaza)	Mecklenburg	0.099	0.103	0.086	0.096
Arrowood	Mecklenburg	0.086	0.094	0.073	0.084
Enochville	Rowan	0.103	0.108	0.087	0.099
Rockwell	Rowan	0.097	0.106	0.098	0.100
Monroe	Union	0.081	0.100	0.083	0.088
York	York, SC	0.080	0.096	0.076	0.084

Values shown in bold represent violations of the 8-hour ozone NAAQS

E. Charlotte-Gastonia-Rock Hill, NC-SC Area

1. Metrolina Area

USEPA designated and classified ozone nonattainment areas according to the calculated 2001-2003 design values listed in Table I-2: "2001-2003 Design Values." An area referred to as the Charlotte-Gastonia-Rock Hill, North Carolina-South Carolina (Metrolina) Area was designated a nonattainment area for the 8-hour ozone standard.

2. Metrolina Nonattainment Area Boundaries

USEPA considered several factors, including emissions, population density, traffic congestion, commercial development, industrial development, meteorological conditions, and pollution transport, in evaluating all counties in and around the MSA to establish the nonattainment area boundaries. The entire North Carolina portion of the MSA, which includes Cabarrus, Gaston, Lincoln, Mecklenburg, Rowan and Union Counties, was designated to be part of the Metrolina nonattainment area. Two North Carolina areas outside of the MSA, Coddle Creek Township and Davidson Township in Iredell County, were determined to be contributing to violating monitors and are included in the Metrolina nonattainment area. Although the monitor in York County, South Carolina during that time was below the 8-hour ozone standard of 0.085 parts per million (ppm), USEPA determined that a portion of York County contributed to violating monitors in nearby North Carolina. That portion of York County, South Carolina, which is situated within the Rock Hill Fort Mill Area Transportation Study (RFATS) Metropolitan Planning Organization (MPO) was designated as a partial county nonattainment area and included in the Metrolina nonattainment area. (It should be noted that the York County ozone monitor is located outside of the designated nonattainment area boundary.)

3. Metrolina Nonattainment Area Classification

USEPA resolved that the Metrolina nonattainment area classification should be based on the highest 8-hour ozone design value calculated for any of the monitors located within the boundaries of the designated nonattainment area. In reviewing the data analysis reflected in Table I-2: "2001-2003 Design Values," the highest regional design value was 0.100 ppm.

In accordance with the classification criteria summarized in Table I-1: "Subpart 2 Classifications and Attainment Dates," USEPA classified the Metrolina area as a Subpart 2, moderate nonattainment area.

The Metrolina nonattainment area must demonstrate attainment of the 8-hour ozone NAAQS by no later than June 15, 2010.

F. Clean Air Act Requirements

Sections 172(c), 182(a), and 182(b) of the *Clean Air Act* (CAA), as amended (42 U.S.C. 7401, *et seq.*), prescribe the requirements for ozone nonattainment areas. All designated nonattainment areas must comply with the general requirements mandated by Section 172(c) of the CAA. As a Subpart 2, moderate ozone nonattainment area, the Metrolina area must also meet the additional requirements prescribed by Section 182 of the CAA. Each State in which all or part of a moderate nonattainment area is located shall make the submissions described under Section 182(a) (relating to marginal nonattainment areas) and shall also submit the revisions to the applicable implementation plan described under Section 182(b) with respect to moderate nonattainment areas. These requirements are listed below and are discussed in more details in Section VI of this attainment SIP.

1. Section 172(c) - Nonattainment Plan Provisions

- a. Reasonably available control measures (RACM)
- b. Reasonable further progress (RFP)
- c. Actual emissions inventory and periodic emissions inventory
- d. New source review (NSR) / Attainment Demonstration
- e. Permit requirements for new and modified sources
- f. Other measures as may be necessary to provide attainment by specified attainment date
- g. Compliance with Section 110(a)(2)
- h. Equivalent techniques
- i. Contingency measures

2. Section 182(a) - Plan Submissions and Requirements for Marginal Areas

- a. Actual emissions inventory in accordance with 172(c)(3)
- b. Corrections to SIP
 - i. Reasonably available control technology (RACT)
 - ii. Motor vehicle inspection and maintenance (I/M)
 - iii. Permit programs
- c. Periodic emissions inventory
 - i. General emission inventory every three years until area is redesignated to attainment
 - ii. Annual emissions statement for sources emitting 25 tons per year or greater of VOC or NO_x

3. Section 182(b) - Additional Plan Submissions and Requirements for Moderate Areas

- a. Reasonable further progress
- b. Reasonable available control technology
- c. Gasoline vapor recovery
- d. Motor vehicle I/M
- e. Offset requirements of at least 1.15 to 1.

SECTION II. ATTAINMENT DEMONSTRATION METHODS AND INPUTS

The attainment modeling for the Metrolina nonattainment area was performed in conjunction with the regional haze modeling being done by the Southeast Regional Planning Organization, Visibility Improvement State and Tribal Association of the Southeast (VISTAS) and the fine particulate matter (PM_{2.5}) and ozone modeling being done by the Association of Southeastern Integrated Planning (ASIP). VISTAS and ASIP are run by the ten Southeast states (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia and West Virginia). Since the regional haze modeling uses annual simulations and includes an intermediate year that is the attainment year required for the Metrolina nonattainment area, NCDAQ and SCDHEC decided to use the this modeling for our ozone attainment demonstration. The sections below outline the methods and inputs used by VISTAS/ASIP for this regional modeling.

A. Analysis Method

The modeling analysis is a complex technical evaluation that begins by selection of the modeling system. VISTAS decided to use the following modeling system:

1. Air Quality Model: USEPA's Models-3/Community Multiscale Air Quality (CMAQ) modeling system is a 'One-Atmosphere' photochemical grid model capable of addressing ozone, particulate matter (PM), visibility and acid deposition at regional scale for periods up to one year.
2. Meteorological Model: The Pennsylvania State University/National Center for Atmospheric Research (PSU/NCAR) Mesoscale Meteorological Model (MM5) is a nonhydrostatic, prognostic meteorological model routinely used for urban- and regional-scale photochemical, fine particulate matter, and regional haze regulatory modeling studies.
3. Emissions Model: The Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system is an emissions modeling system that generates hourly gridded speciated emission inputs of mobile, nonroad mobile, area, point, fire and biogenic emission sources for photochemical grid models.

Additionally, a historical year is selected to model that represent typical meteorological conditions in the Southeast when high ozone, PM_{2.5} and poor visibility are observed throughout the Region. Once the historical year is selected, meteorological inputs are developed using the meteorological model. Emission inventories are also developed for the historical year and processed through the emissions model. These inputs are used in the air quality model to predict ozone, PM_{2.5} and visibility, with the results compared to the historic data. The model performance is evaluated by comparing the modeled predicted data to the historic air quality data.

Once model performance is deemed adequate, typical baseline and future year emissions are processed through the emissions model. For this demonstration, the baseline year was 2002, which corresponds with the same year as the historic meteorology used in the modeling. The attainment future year NCDAQ and SCDHEC are using for this demonstration is 2009, since the mandatory attainment date for the Metrolina area is June 15, 2010. Since this attainment date is set prior to the completion of the 2010 ozone season, the attainment of the NAAQS would have to be met by the end of the 2009 ozone season. These 2002 baseline and 2009 future typical emissions are processed through the air quality model with the meteorological inputs. The air quality modeling results are used to determine a relative reduction in future ozone, which is used in the attainment demonstration.

The complete modeling protocol used for this analysis can be found in Appendix D.

B. Model Selection

To ensure that a modeling study is defensible, care must be taken in the selection of the models to be used. The models selected must be scientifically appropriate for the intended application and be freely accessible to all stakeholders. Scientifically appropriate means that the models address important physical and chemical phenomena in sufficient detail using peer-reviewed methods. Freely accessible means that model formulations and coding are freely available for review and that the models are available to stakeholders and their consultants for execution and verification at no or low cost.

The following sections outline the criteria for selecting a modeling system that is both defensible and capable of meeting the study's goals. These criteria were used in selecting the modeling system used for this modeling attainment demonstration.

1. Selection of Photochemical Grid Model

a. Criteria

For a photochemical grid model to qualify as a candidate for use in an attainment demonstration of the 8-hour ozone NAAQS, a State needs to show that it meets several general criteria:

- The model has received a scientific peer review;
- The model can be demonstrated applicable to the problem on a theoretical basis;
- Databases needed to perform the analysis are available and adequate;
- Appropriate performance evaluations have shown the model is not biased toward underestimates or overestimates;
- A protocol on methods and procedures to be followed has been established; and
- The developer of the model must be willing to make the source code available to users for free or for a reasonable cost, and the model cannot otherwise be proprietary.

b. Overview of CMAQ

The photochemical model selected for this study was CMAQ version 4.4. For more than a decade, USEPA has been developing the Models-3 CMAQ modeling system with the overarching aim of producing a 'One-Atmosphere' air quality modeling system capable of addressing ozone, fine particulate matter, visibility, and acid deposition within a common platform. The original justification for the Models-3 development emerged from the challenges posed by the 1990 CAAA and USEPA's desire to develop an advanced modeling framework for 'holistic' environmental modeling utilizing state-of-science representations of atmospheric processes in a high performance computing environment. USEPA completed the initial stage of development with Models-3 and released the CMAQ model in mid 1999 as the initial operating science model under the Models-3 framework. The most recent rendition is CMAQ version 4.4, which was released in October 2004.

Another reason for choosing CMAQ as the atmospheric model is the ability to do one-atmospheric modeling. Since SCDHEC will be using the same modeling exercise for the ozone attainment demonstration SIP as well as the regional haze SIP, having a model that can handle both ozone and particulate matter is essential. A number of features in CMAQ's theoretical formulation and technical implementation make the model well suited for annual particulate matter modeling.

The configuration used for this modeling demonstration, as well as a more detailed description of the CMAQ model, can be found in the Modeling Protocol (Appendix D).

2. Selection of Meteorological Model

a. Criteria

Meteorological models, either through objective, diagnostic, or prognostic analysis, extend available information about the state of the atmosphere to the grid upon which photochemical grid modeling is to be carried out. The criteria for selecting a meteorological model are based on the model's ability to both accurately replicate important meteorological phenomena in the region of study and interface with the rest of the modeling systems--particularly the photochemical grid model. With these issues in mind, the following criteria were established for the meteorological model to be used in this study:

- Non-Hydrostatic Formulation
- Reasonably current, peer reviewed formulation
- Simulates Cloud Physics
- Public availability at no or low cost
- Output available in I/O API format
- Supports Four Dimensional Data Assimilation (FDDA)
- Enhanced treatment of Planetary Boundary Layer heights for air quality modeling

b. Overview of MM5

The non-hydrostatic MM5 model is a three-dimensional, limited-area, primitive equation, prognostic model that has been used widely in regional air quality modeling applications. The basic model has been under continuous development, improvement, testing and open peer-review for more than 20 years and has been used worldwide by hundreds of scientists for a variety of mesoscale studies.

MM5 uses a terrain-following non-dimensionalized pressure, or "sigma," vertical coordinate similar to that used in many operational and research models. In the non-hydrostatic MM5, the sigma levels are defined according to the initial hydrostatically-balanced reference state so that the sigma levels are also time-invariant. The gridded meteorological fields produced by MM5 are directly compatible with the input requirements of 'one atmosphere' air quality models using the same coordinate system. MM5 fields can be easily used in other regional air quality models with different coordinate systems by performing a vertical interpolation, followed by a mass-conservation adjustment.

Distinct planetary boundary layer (PBL) parameterizations are available for air quality applications, both of which represent sub-grid-scale turbulent fluxes of heat, moisture, and momentum. One scheme uses a first-order eddy diffusivity formulation for stable and neutral environments and a modified first-order scheme for unstable regimes. The other scheme uses a prognostic equation for the second-order turbulent kinetic energy, while diagnosing the other key boundary layer terms.

Initial and lateral boundary conditions are specified for real-data cases from mesoscale three-dimensional analyses performed at 12-hour intervals on the outermost grid mesh selected by the user. Surface fields are analyzed at three-hour intervals. A Cressman-based technique is used to analyze standard surface and radiosonde observations using the National Meteorological Center's spectral analysis as a first guess. The lateral boundary data are introduced using a relaxation technique applied in the outermost five rows and columns of the coarsest grid domain.

Results of detailed performance evaluations of the MM5 modeling system in regulatory air quality application studies have been widely reported in the literature (e.g., Emery et al., 1999; Tesche et al., 2000, 2003), and many have involved comparisons with other prognostic models such as the Regional Atmospheric Modeling System (RAMS) and the Systems Application International Mesoscale Model.

The MM5 enjoys a far richer application history in regulatory modeling studies compared with RAMS or other models. Furthermore, in evaluations of these models in over 60 recent regional scale air quality application studies since 1995, it has generally been found that the MM5 model tends to produce somewhat better photochemical model inputs than alternative models.

The configuration used for this modeling demonstration, as well as a more detailed description of the MM5 model, can be found in the Modeling Protocol (Appendix D).

3. Selection of Emissions Processing System

a. Criteria

The principal criterion for an emissions processing system is that it accurately prepares emissions files in a format suitable for the photochemical grid model being used. The following list includes clarification of this criterion and additional desirable criteria for effective use of the system.

- File System Compatibility with the I/O API
- File Portability
- Ability to grid emissions on a Lambert Conformal projection
- Report Capability
- Graphical Analysis Capability
- MOBILE6 Mobile Source Emissions
- Biogenic Emissions Inventory System version 2 (BEIS-3)
- Ability to process emissions for the proposed domain in a reasonable amount of time
- Ability to process control strategies
- No or low cost for acquisition and maintenance
- Expandable to support other species and mechanisms

b. Overview of SMOKE

The SMOKE Emissions Processing System Prototype was originally developed at the Micro-computing Center of North Carolina. As with most ‘emissions models,’ SMOKE is principally an emission processing system and not a true emissions modeling system in which emissions estimates are simulated from ‘first principles’. This means that, with the exception of mobile and biogenic sources, its purpose is to provide an efficient, modern tool for converting emissions inventory data into the formatted emission files required by an air quality simulation model. For mobile sources, SMOKE actually simulates emissions rates based on input mobile-source activity data, emission factors and outputs from transportation travel-demand models.

SMOKE was originally designed to allow emissions data processing methods to utilize emergent high-performance-computing as applied to sparse-matrix algorithms. Indeed, SMOKE is the fastest emissions processing tool currently available to the air quality modeling community. The sparse matrix approach utilized throughout SMOKE permits both rapid and flexible processing of emissions data. The processing is rapid because SMOKE utilizes a series of matrix calculations instead of less efficient algorithms used in previous systems. The processing is flexible because the processing steps of temporal projection, controls, chemical speciation, temporal allocation, and spatial allocation have been separated into independent operations wherever possible. The results from these steps are merged together at a final stage of processing.

SMOKE contains a number of major features that make it an attractive component of the modeling system. The model supports a variety of input formats from other emissions processing systems and

models. It supports both gridded and county total land use schemes for biogenic emissions modeling. SMOKE can accommodate emissions files from up to 10 countries and any pollutant can be processed by the system.

For additional information about the SMOKE model please refer to the Modeling Protocol (Appendix D).

C. Episode Selection

A crucial step to SIP modeling is the selection of episodes to model. Several considerations need to be weighed before settling on not only which days to model, but how many days are modeled for each episode. This section details the guidance and process by which episodes were selected for the 8-hour Ozone SIP modeling package.

1. Overview of USEPA Guidance on Ozone

USEPA's guidance on 8-hour ozone modeling sets out specific criteria for the selection of episodes to model for attainment of the 8-hour ozone NAAQS. First, episodes should include days encompassing a variety of meteorological conditions, including varying wind directions, for days exceeding 0.084 ppm. Additionally, episodes should be selected that contain days close to (within ± 0.010 ppm) the current design value (DVC). Episodes should also be chosen around days for which there are extensive air quality and meteorology measurements, including measurements aloft, measurements of indicator species and/or precursor measurements. Finally, a sufficient number of days should be selected to ensure robust attainment tests at violating monitoring sites.

USEPA also suggests a set of secondary criteria, in addition to the primary criteria, that may be used in the selection of episodes. This set of criteria allows states to give preference to previously modeled episodes. This is a very valuable consideration, as USEPA points out, since it can save modeling resources and effort. Additional considerations include selecting episodes maximizing the number of days and sites observing a violation, selecting episodes that include weekends, and, when considering regional scale modeling, selecting episodes that meet primary and secondary criteria in other nonattainment areas. Using these criteria laid out by USEPA, the data available was systematically examined to determine the best episodes for modeling.

2. Episode Selection

With the advances in computing and storage technologies, and with the aid provided by regional modeling efforts, NCDAQ and SCDHEC intend to move toward the modeling of the peak ozone season for the 8-hour ozone attainment demonstration SIP. By modeling the peak season, several criteria are covered, including the modeling of weekends and a sufficient number of days to ensure a robust modeled attainment test. Modeling the peak ozone season will also accomplish the goal of encompassing a myriad of meteorological conditions that influence tropospheric ozone formation.

Efforts were made to determine an appropriate period to model. The selection process started with an examination of the 8-hour ozone maxima for the 1997 through 2004 seasons to determine which season may yield the most days to be included for study. Following the second primary criteria, the number of days each monitoring site observed a value within 0.010 ppm of the design value was tabulated using the recently suggested 5-year weighted average (the average of the three 3-year design values in the five year period centered on the base year).

It was found that, overall, 2002 had the most days within 0.010 ppm of the design values, and

generally had the most exceedance days for the individual monitoring sites. When 2002 was not the highest year, it was generally either the second or third highest for either design value convention. Since 2002 was the base year for the VISTAS modeling as well, choosing the 2002 ozone season for the episode allowed the use of the VISTAS ASIP modeling for the attainment demonstration for ozone.

The months of May through September 2002 were typical of the meteorology one would expect for an active ozone season, namely warmer and drier than average. Temperatures were 1 to 2 °F warmer than average across the state and throughout the Mid-Atlantic States, and the precipitation values were 4-6 inches below normal for most of the Carolinas. The dry conditions were also present for much of the coastal Mid-Atlantic States. The warmer and drier conditions led to lower soil moisture throughout much of the East coast, which reduced the evaporation of moisture into the air and decreased dew point temperatures. With less available moisture in the atmosphere, cloud cover was decreased, which led to more sunlight, increased photochemistry, and higher levels of ozone across the region.

Additionally, the episode classification further verifies that the 2002 ozone season is a representative year for use in attainment demonstration modeling. The 2002 ozone season encompasses six of the region's typical meteorological scenarios: eastern stacked highs, frontal approaches, Canadian highs, modified Canadian highs, progressive continental highs and the subcategory of tropical influence. Thus, the 2002 season provides an excellent case to evaluate various control strategies for maintaining the NAAQS for ozone.

For these reasons, the 2002 ozone season was selected as the episode to model for the attainment demonstration. Further details of the episode selection process, episode classification procedures, and episode classifications for the 2002 ozone season can be found in the Modeling Protocol (Appendix D).

D. Modeling Domains

1. Horizontal Modeling Domain

The CMAQ model was run in one-way nested grid mode. This allowed the larger outer domains to feed concentration data to the inner nested domain. One-way nesting is believed to be appropriate for the generally stagnant conditions experienced during Metrolina ozone episodes. Two-way nesting was not considered due to numerical and computational uncertainty associated with the technique.

The horizontal coarse grid modeling domain boundaries were determined through a national effort to develop a common grid projection and boundary. Since this national modeling domain was used in the VISTAS regional haze modeling, it was used for the attainment demonstration as well. A smaller 12-km grid modeling domain was selected in an attempt to balance location of areas of interest, such as ozone and fine particulate matter nonattainment areas, as well as Class 1 and wilderness areas for regional haze. Processing time was also a factor in choosing a smaller 12-km grid modeling domain.

The coarse 36-km horizontal grid domain covers the continental United States. This domain was used as the outer grid domain for MM5 modeling with the CMAQ domain nested within the MM5 domain. Figure II-1 shows the MM5 horizontal domain as the outer most, blue grid with the CMAQ 36-km domain nested in the MM5 domain.

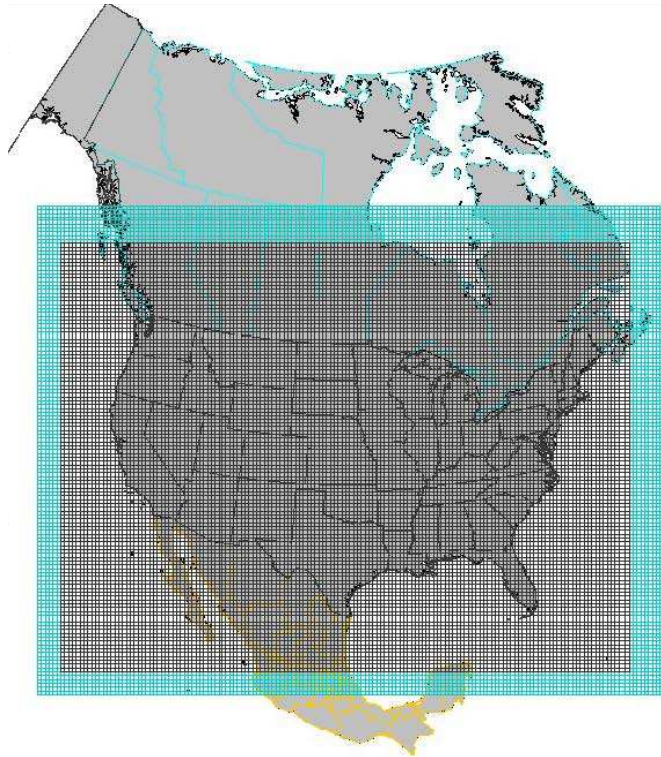


Figure II-1: The MM5 horizontal domain is the outer most, blue grid, with the CMAQ 36-km domain nested in the MM5 domain.

To achieve finer spatial resolution in the VISTAS states, a one-way nested high resolution (12 km grid resolution) was used. Figure II-2 shows the 12-km grid modeling domain for the VISTAS region. This is the modeling domain on which the attainment test results are based. A study was performed to determine if using a finer grid resolution provided different modeling results. Since the USEPA's attainment test uses the modeling results to determine the relative reductions in ozone between the base year and the future year, it was determined that essentially the same attainment test results are obtained from either 12-km grid modeling or 4-km grid modeling. Since 4-km grid modeling takes significantly more time and resources to run, it was decided that the VISTAS 12-km grid modeling results for this attainment demonstration would be used. A copy of a journal article describing the results of the grid resolution study can be found in Appendix N.

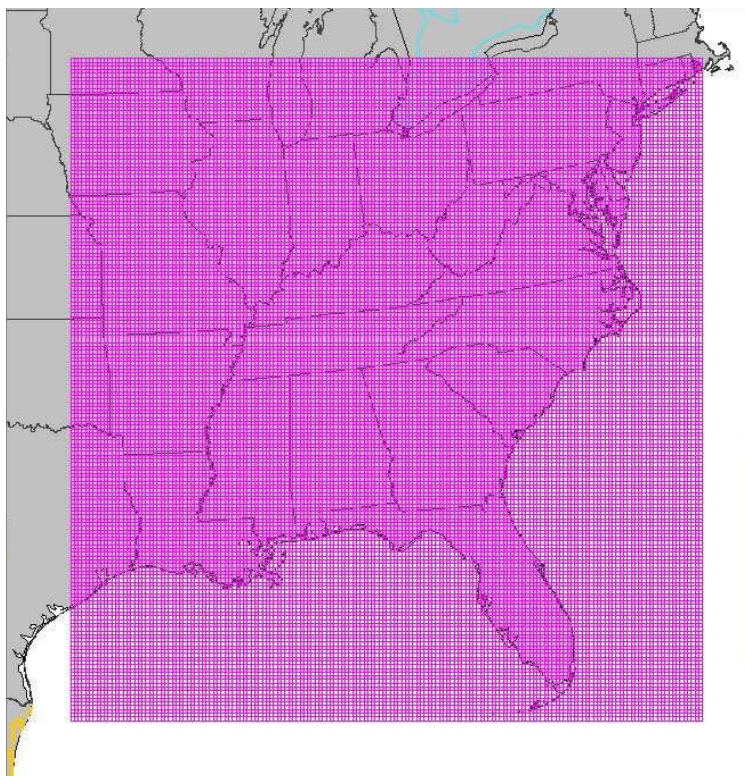


Figure II-2: A more detailed view of the 12-km grid over the VISTAS region.

2. Vertical Modeling Domain

The CMAQ vertical structure is primarily defined by the vertical grid used in the MM5 modeling. The MM5 model employed a terrain following coordinate system defined by pressure, using 34 layers that extend from the surface to the 100 mb layer. Table II-1 lists the layer definitions for both MM5 and for CMAQ. A layer-averaging scheme is adopted for CMAQ to reduce the computational cost of the CMAQ simulations. The effect of layer averaging was evaluated in conjunction with the VISTAS modeling effort. It was found that layer averaging had a relatively minor effect on the model performance metrics when both the 34 layer and a 19 layer CMAQ models were compared to ambient monitoring data. A discussion of the modeling sensitivity for this layer averaging can be found in Section 9.1 of the VISTAS Model Performance Evaluation and Model Sensitivity Tests for Three Phase I Episodes report dated September 7, 2004.

Table II-1: Vertical Layer Definition for MM5 and CMAQ

MM5 Simulation					CMAQ 19 Layers				
Layer	Sigma	Pressure (mb)	Height (m)	Depth (m)	Layer	Sigma	Pressure (mb)	Height (m)	Depth (m)
34	0.000	100	14662	1841	19	0.000	100	14662	6536
33	0.050	145	12822	1466		0.050	145		
32	0.100	190	11356	1228		0.100	190		
31	0.150	235	10127	1062		0.150	235		
30	0.200	280	9066	939		0.200	280		
29	0.250	325	8127	843	18	0.250	325	8127	2966
28	0.300	370	7284	767		0.300	370		
27	0.350	415	6517	704		0.350	415		
26	0.400	460	5812	652		0.400	460		
25	0.450	505	5160	607	17	0.450	505	5160	1712
24	0.500	550	4553	569		0.500	550		
23	0.550	595	3984	536		0.550	595		
22	0.600	640	3448	506	16	0.600	640	3448	986
21	0.650	685	2942	480		0.650	685		
20	0.700	730	2462	367	15	0.700	730	2462	633
19	0.740	766	2095	266		0.740	766		
18	0.770	793	1828	259	14	0.770	793	1828	428
17	0.800	820	1569	169		0.800	820		
16	0.820	838	1400	166	13	0.820	838	1400	329
15	0.840	856	1235	163		0.840	856		
14	0.860	874	1071	160	12	0.860	874	1071	160
13	0.880	892	911	158	11	0.880	892	911	158
12	0.900	910	753	78	10	0.900	910	753	155
11	0.910	919	675	77		0.910	919		
10	0.920	928	598	77	9	0.920	928	598	153
9	0.930	937	521	76		0.930	937		
8	0.940	946	445	76	8	0.940	946	445	76
7	0.950	955	369	75	7	0.950	955	369	75
6	0.960	964	294	74	6	0.960	964	294	74
5	0.970	973	220	74	5	0.970	973	220	74
4	0.980	982	146	37	4	0.980	982	146	37
3	0.985	986.5	109	37	3	0.985	986.5	109	37
2	0.990	991	73	36	2	0.990	991	73	36
1	0.995	995.5	36	36	1	0.995	995.5	36	36
0	1.000	1000	0	0	0	1.000	1000	0	0

E. Emission Inventory

There are five different emission inventory source classifications: stationary point and area sources, off-road and on-road mobile sources, and biogenic sources. Stationary point sources are those sources that emit greater than a specified tonnage per year and the data is provided at the facility level. Stationary

area sources are those sources whose emissions are relatively small but due to the large number of these sources, the collective emissions could be significant (e.g., dry cleaners, service stations, etc.). These types of emissions are estimated on the county level. Off-road mobile sources include equipment (e.g., lawn mowers, construction equipment, railroad locomotives, aircraft, etc.) that can move, but do not use the roadways. The emissions from these sources, like stationary area sources, are estimated on the county level. On-road mobile sources are automobiles, trucks, and motorcycles that use the roadway system. The emissions from these sources are estimated by vehicle type and road type and are summed to the county level. Biogenic sources are the natural sources like trees, crops, grasses, and natural decay of plants. The emissions from these sources are estimated on a county level.

In addition to the various source classifications, there are also various types of emission inventories. The first is the actual base year inventory. This inventory is the base year emissions that correspond to the meteorological data. For this modeling effort, the base year is 2002. These emissions are used for evaluating the air quality model performance.

The second type of inventory is the typical base year inventory. This inventory is similar to the actual base year. However, for sources that may have significant changes from year-to-year, a more typical emission value is used. In this modeling effort, typical emissions were developed for electric generating units (EGUs) and wildland fire emissions. The air quality modeling results using these emissions are used in calculating the relative response factors used in the attainment demonstration test. The future year base inventory is an inventory developed for some future year for which attainment of the ozone standard is needed. For this modeling project, the future year inventory will be 2009, the last complete year for which the standard must be attained. It is the future base year inventory to which control strategies and sensitivities are applied to determine what controls beyond those measures already included in the future year base inventory, to which source classifications must be made in order to attain and maintain the ozone standard.

In the sections that follow, a synopsis of the inventories used for each source classifications are discussed. Detailed discussions of the emissions inventory development can be found in Appendix F, and emission summaries by county for the Metrolina nonattainment area and for the State are in Appendix E.

1. Stationary Point Sources

Point source emissions are those emissions from larger individual sources having a fixed location. Generally, these sources must have permits to operate, and their emissions are inventoried on a regular schedule. Large sources having emissions of 100 tons per year (tpy) of a criteria pollutant, 10 tpy of a single hazardous air pollutant (HAP), or 25 tpy total HAP are inventoried regularly. Smaller sources have not been inventoried and are included in the area source inventory. The point source emissions data can be grouped into the EGU sources and the other point sources (e.g., non-EGUs).

a. Electric Generating Units

The actual base year inventory for the EGU sources used 2002 continuous emissions monitoring (CEM) data reported to USEPA's Acid Rain program or 2002 hourly emissions data provided by stakeholders. This data provides hourly emissions profiles that can be used in the modeling of these large sources of NO_x and helps to provide more accurate modeling of these sources.

Since the NO_x emissions from EGU sources are a significant part of the emissions inventory, a typical base year emissions inventory was developed for these sources to avoid anomalies in emissions due to variability in meteorology and economic and outage factors in 2002. This approach is consistent with USEPA's modeling guidance. To develop a typical year 2002 emissions inventory for EGU sources,

the average CEM heat input for 2000 through 2004 was divided by the 2002 actual heat input for each unit to generate a unit specific normalizing factor. This normalizing factor was then multiplied by the 2002 actual emissions. The heat inputs for the period 2000 through 2004 were used since the modeling current design values use monitoring data from this same five-year period. If a unit was shutdown for an entire year during the 2000 through 2004 period, the average of the years the unit was operational was used. If a unit was shutdown temporarily in 2002, the emissions and heat inputs for 2001 (or 2000) were used in the normalizing calculations.

As part of the VISTAS modeling, VISTAS and the Midwest Regional Planning Organization contracted with ICF Resources, L.L.C., to generate the future year emission inventory for the electric generating sector of the contiguous United States using the Integrated Planning Model (IPM). IPM is a dynamic linear optimization model that can be used to examine air pollution control policies for various pollutants throughout the contiguous United States for the entire electric power system. The dynamic nature of IPM enables the projection of the behavior of the power system over a specified future period. The optimization logic determines the least-cost means of meeting electric generation and capacity requirements while complying with specified constraints including air pollution regulations, transmission bottlenecks, and plant-specific operational constraints. The versatility of IPM allows users to specify which constraints to exercise and populate IPM with their own datasets.

The IPM modeling runs took into consideration USEPA's Clean Air Interstate Rule (CAIR) implementation and North Carolina's Clean Smokestacks Act compliance plans for Duke Power and Progress Energy.

b. Other Point Sources

For the non-EGU sources, the same inventory will be used for both the actual and typical base year emissions inventories. The non-EGU category will use annual emissions as reported for the Consolidated Emissions Reporting Rule (CERR) for the year 2002. These emissions were temporally allocated to month, day, and hour using source category code (SCC) based allocation factors using the SMOKE emissions model.

The general approach for assembling future year data was to use recently updated growth and control data consistent with USEPA's CAIR analyses. This data was supplemented with state specific growth factors and stakeholder input on growth assumptions.

2. Stationary Area Sources

Stationary area sources include sources whose emissions are relatively small but, due to their large numbers, whose collective emissions could be significant (e.g., combustion of fuels for heating, structure fires, service stations, etc.). Emissions are estimated by multiplying an emission factor by some known indicator of collective activity, such as fuel usage, number of households, or population. Stationary area source emissions are estimated on the county level.

The area source 2002 base year inventory for South Carolina was developed by the VISTAS/ASIP contractor. The VISTAS/ASIP contractor used the 2002 CERR as the basis for the area source inventory. The sources estimated by the contractor include emissions from animal husbandry, wildland fires, and particulate matter from paved and unpaved roads. For the other states within the modeling domain, the state supplied data or the CERR data for 2002 was used.

The actual base year inventory will serve as the typical base year inventory for all area source categories except for wildland fires. For this source category, development of a typical year fire

inventory provided the capability of using a comparable data set for both the base year and future years. Thus, fire emissions would remain the same for air quality modeling in both the base and any future years. The VISTAS Fire Special Interest Work Group was consulted and decided that State-level ratios of acres over a longer term record (three or more years) developed for each fire type relative to 2002 would be used. The 2002 acreage was then scaled up or down based on these ratios to develop a typical year inventory.

For categories other than wildland fires, the VISTAS/ASIP contractor generated the future base year emissions inventory used in the attainment demonstration modeling. Growth factors supplied from the states or USEPA's CAIR emission projections were applied to project the controlled emissions to the appropriate year. In some cases, USEPA's Economic Growth and Analysis System Version 5 growth factors were used if no growth factor was available from either the states or the CAIR growth factor files.

3. Nonroad Mobile Sources

Nonroad mobile sources include equipment that can move but do not use the roadways, such as construction equipment, aircraft, railroad locomotives, lawn and garden equipment, etc. For the majority of the nonroad mobile sources, the emissions were estimated using USEPA's NONROAD2005c model. For the three source categories not included in the NONROAD model (aircraft engines, railroad locomotives, and commercial marine engines), more traditional methods of estimating the emissions were used. The same inventory will be used for both the actual and typical base year emissions inventories for the nonroad mobile sources.

For the source categories estimated using USEPA's NONROAD model, the model was used to create a future base year inventory. The NONROAD model takes into consideration rules that are in effect that could impact the emissions from these source categories. For the commercial marine, railroad, and airport emissions, the VISTAS/ASIP contractor calculated the future base year emissions using detailed inventory data (both before and after controls) for 1996 and 2010 obtained from USEPA's *Clean Air Interstate Rule Technical Support Document*. When available, state specific growth factors were used.

4. Highway Mobile Sources

In order to accurately model the mobile source emissions in the Metrolina nonattainment area, the newest version of the MOBILE model, MOBILE6.2, was used. Key inputs for the MOBILE model include information on the age of vehicles on the roads, the average speed on the roads, the mix of vehicles on the roads, any control technologies in place in an area to reduce emissions for motor vehicles (e.g., emissions inspection programs), and temperature.

The MOBILE model takes into consideration rules that are in effect that impact the emissions from this source sector. For highway mobile sources, the actual and typical year emissions were the same and the MOBILE model was run using input data reflective of 2002. The same model then is run for the future year emissions inventory using input data reflective of 2009. The 2002 and 2009 vehicle miles traveled (VMT) are based on data provided by the South Carolina Department of Transportation (SCDOT).

5. Biogenic Emission Sources

Biogenic emissions were prepared with the SMOKE-BEIS3 (Biogenic Emission Inventory System 3 version 0.9) preprocessor. SMOKE-BEIS3 is basically the Urban Airshed Model (UAM)-BEIS3 model, but also includes modifications to use MM5 data, gridded land use data, and science updates. The

emission factors that are used in SMOKE-BEIS3 are the same as the emission factors in UAM-BEIS3.

The basis for the gridded land use data used by BEIS3 is the county land use data in the Biogenic Emissions Landcover Database version 3 (BELD3) provided by USEPA. A separate land classification scheme, based upon satellite (AVHRR, 1 km spatial resolution) and census information, aided in defining the forest, agriculture, and urban portions of each county.

SECTION III. MODEL PERFORMANCE EVALUATION

There are many accepted methodologies for evaluating the performance of any air quality model. This section, however, will focus primarily on the methods and techniques recommended by USEPA for evaluating the performance of air quality models. Before the air quality model can be fully evaluated, a comprehensive understanding of the performance of the meteorological model being used for its inputs is essential. This evaluation should be specifically designed to identify potential biases and errors that may be passed directly from the meteorological model into the air quality model. The meteorological modeling evaluation is fully documented in Appendix I and is briefly summarized in the next few paragraphs.

Generally speaking, the meteorological modeling performance was quite good at both the 36-km and 12-km grid resolutions. Synoptic features were accurately predicted and the meteorological model showed considerable skill in replicating all important atmospheric variables (e.g., temperature, mixing ratio, relative humidity, wind speed and direction, cloud cover, and precipitation) necessary to drive the CMAQ air quality model. Performance statistics show that the meteorological modeling results fell within expected and acceptable ranges of error during the majority of the 2002 modeled year.

The meteorological modeling performance for North and South Carolina was very similar to the performance for the VISTAS/ASIP region for the 12-km modeling domain. As before, large-scale meteorological patterns were accurately predicted. The meteorological model demonstrated substantial skill throughout the entire 2002 modeling year, and was especially skillful during the summertime (core ozone) season from May through September.

For the North Carolina portion of the 12km modeling domain (which includes York County, SC), the temperature bias was near zero in May, June, and August. July had a slight negative temperature bias near -0.25 Kelvin (K), and September had a negative temperature bias of -0.1 K. The mixing ratio bias was near 0 gram/kilogram (g/kg) in May through July and then fell to -0.2 g/kg in August and to -0.6 in September. The relative humidity bias generally hovered around $\pm 3\%$ throughout the summer. Cloud coverage bias peaked near 10% in July and was biased less than 5% during the other summertime months. Wind direction was the most erratic of the measurements. The direction bias throughout North Carolina was more pronounced than for the full 12-km domain, being more negative May through July, and more positive in August and September. When considering all wind measurements, the wind speed was 0.8 to 1.0 meters per second (m/s) too strong. When omitting calm observations, the bias falls to 0.2 to 0.5 m/s. Additionally, the meteorological model noticeably overestimated the amount of summertime precipitation across both Carolinas. However, it was reasonably accurate in reproducing the spatial coverage of measurable precipitation.

Overall, excess wind speeds, increased relative humidity, more daytime cloud cover, and precipitation overestimations will likely contribute to slight under predictions of the daily maximum peak ozone concentration in the CMAQ air quality model. Based on the comprehensive VISTAS & NCDAQ evaluation of the 2002 VISTAS MM5 results, SCDHEC believes that the meteorological model performance is adequate for this modeling exercise for the York County, SC portion of the Metrolina 8-hour Nonattainment Area, and should produce credible inputs for CMAQ air quality modeling for the Metrolina Area attainment demonstration.

Following the meteorological modeling performance evaluation, the next step in the modeling process was to verify the actual air quality model's performance in terms of its ability to predict the ozone in the right locations and at the right levels. To do this, the actual base year model predictions were compared to the ambient data observed in the historical season (2002). The methodology in this type of verification involved a combination of statistical and graphical evaluations, with the goal of determining

if the air quality model appears to be reproducing ozone trends in the right locations for the right reasons. If this goal is met, then the model can reasonably be used as a predictive tool in evaluating various control strategies and their effects on ozone.

The key statistical measures used to evaluate CMAQ air quality model performance for the Metrolina Area attainment demonstration are as follows:

1. Comparison of modeled mean of ozone to the observed mean of ozone. This metric is an evaluation of how, on average across the modeling period, the model compares to the observed values.
2. Bias in the model, calculated by taking the difference between the modeled mean and the observed mean.
3. Normalized bias, calculated by taking the bias for each observation/prediction pair, and then dividing by the number of pairs that are used in the calculations. USEPA recommends that normalized bias fall between $\pm 5 - 15$ percent.
4. Gross error. For the entire modeling domain, gross error for all pairs above 60 parts per billion (ppb) of ozone was calculated. For the Metrolina nonattainment area, the gross error was calculated on the daily 8-hour ozone maximums. The USEPA guidance suggests that gross error can be interpreted as precision of the model. This metric is typically used to compare various modeling applications. USEPA recommends that the gross error of all pairs >60 ppb be less than 30-35 percent.

These statistics will be presented in the sections that follow for the entire 12-km VISTAS/ASIP modeling domain, then, specifically, for the Metrolina nonattainment area.

In addition to statistical methods, model performance was evaluated by reviewing spatial and time series plots of the modeled versus observed data. These graphical plots aided in gaining a better understanding of how the model performed across the entire modeling domain.

Only the model performance evaluation for the 12-km grid domain will be discussed in the subsections to follow. For the full model performance evaluation for both the 36-km and 12-km grid domains, please refer to Appendix J.

A. Domain-Wide Performance

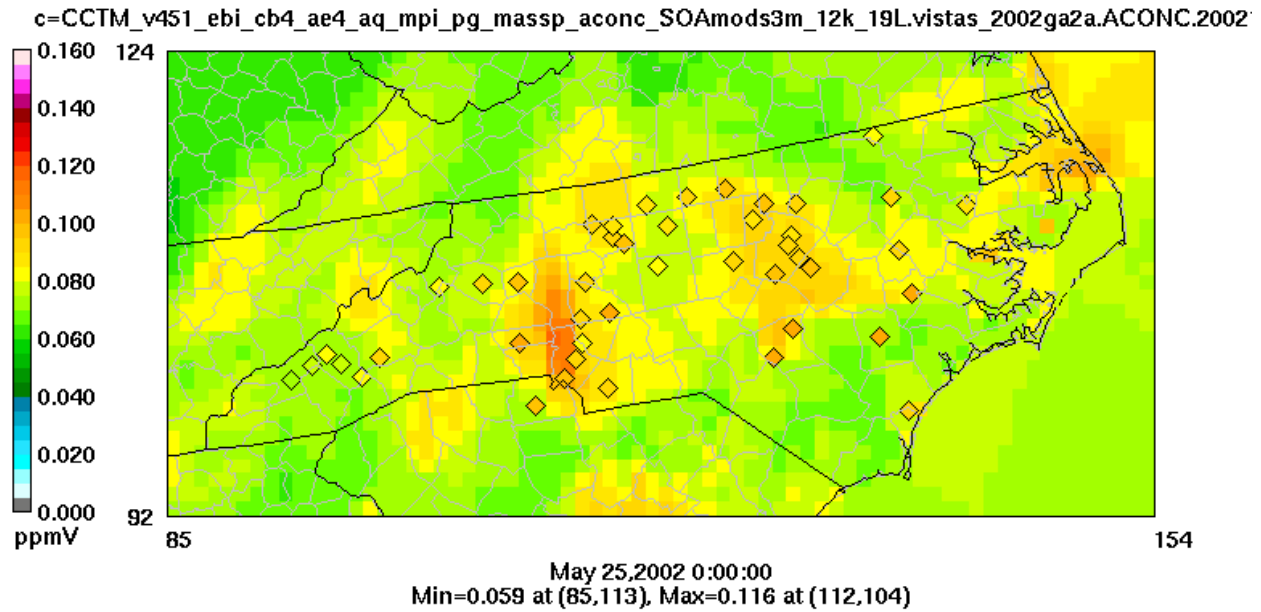
As a first-line screening of overall CMAQ model performance, 8-hour ozone statistical metrics were calculated for the 12-km domain for the VISTAS/ASIP states, North Carolina, and South Carolina (presented in Table III-1). The mean normalized bias was well within the recommended $\pm 5 - 15$ percent for the entire "core ozone" season (May through September). The individual monthly statistics for August and September in North and South Carolina, however, showed a mean normalized bias slightly outside the suggested range. This suggests an under prediction of ozone by the model toward the end of the summer. However, SCDHEC does not believe this slight under prediction for August and September impacts the overall modeling results. The mean normalized gross error was significantly below the 30-35 percent range at the 60 ppb threshold for all regions across the domain.

Table III-1: 12-km Domain Model Statistics for 8-Hour Ozone					
Region/Month	Modeled Mean (ppb)	Observed Mean (ppb)	Mean Bias (ppb)	Mean Normalized Bias (%)	Mean Normalized Gross Error (%)
ASIP States combined					
May	61.26	67.69	-6.44	-8.96	12.47
June	62.62	70.99	-8.37	-11.37	14.02
July	62.73	70.85	-8.12	-10.90	14.74
August	61.33	72.57	-11.24	-14.92	16.98
September	60.81	71.98	-11.17	-14.98	17.07
Mean (May-September)	61.75	70.82	-9.07	-12.23	15.06
North Carolina					
May	64.06	69.05	-5	-6.86	10.76
June	62.21	71.82	-9.62	-13.03	14.47
July	62.94	72.10	-9.16	-12.09	14.63
August	60.60	73.92	-13.33	-17.40	18.34
September	57.90	69.37	-11.46	-16.11	17.68
Mean (May-September)	61.54	71.25	-9.71	-13.10	15.18
South Carolina					
May	63.87	67.71	-3.85	-5.31	9.66
June	61.95	70.92	-8.97	-12.10	13.52
July	60.89	70.24	-9.35	-12.73	14.75
August	59.77	71.39	-11.62	-16.03	16.64
September	61.18	72.62	-11.44	-15.22	16.32
Mean (May-September)	61.53	70.58	-9.05	-12.28	14.18

1. Spatial Plots

Overall, the model performed well with the spatial extent of higher ozone concentrations. There is, however, a slight under-prediction of the ozone in the model, most notably in the 1-hour ozone plots. As expected, higher ozone concentrations are seen in the urban areas. In general, SCDHEC believes the model does an acceptable job capturing the spatial distribution and concentrations of ozone in the Metrolina area. Appendix J shows all of the domain-wide spatial plots of modeled 1-hour and 8-hour maximum ozone with the observations, overlaid for the days used in the relative response factor (RRF) calculations. Only representative days are displayed below in Figure III-1 through Figure III-7.

Daily Max 1-hour Ozone



Daily Max 8-hour Ozone

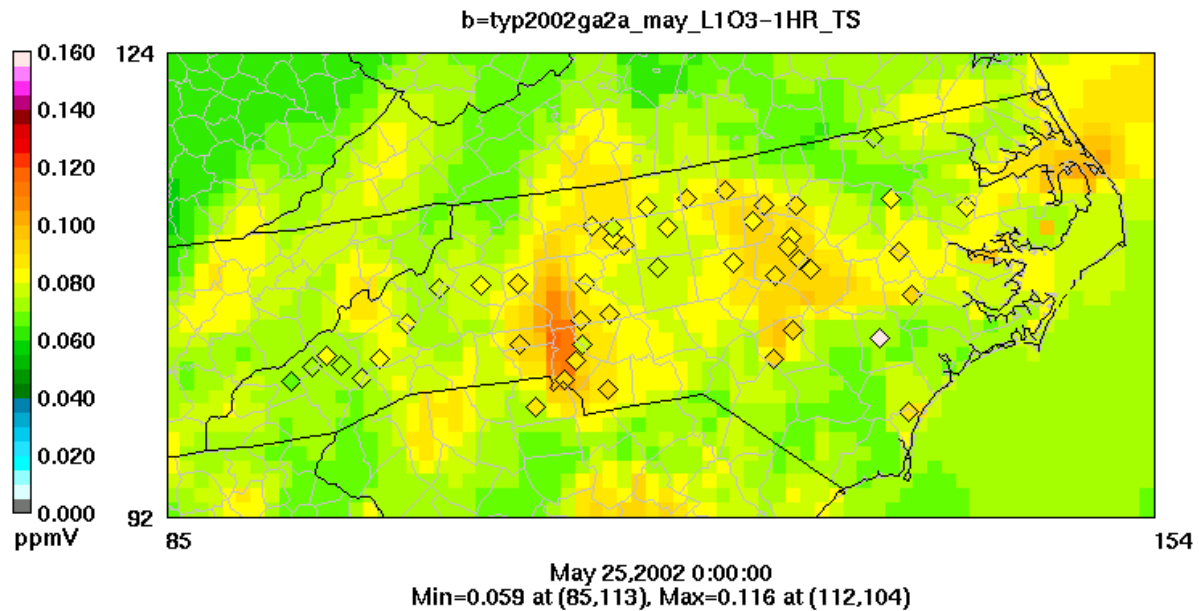
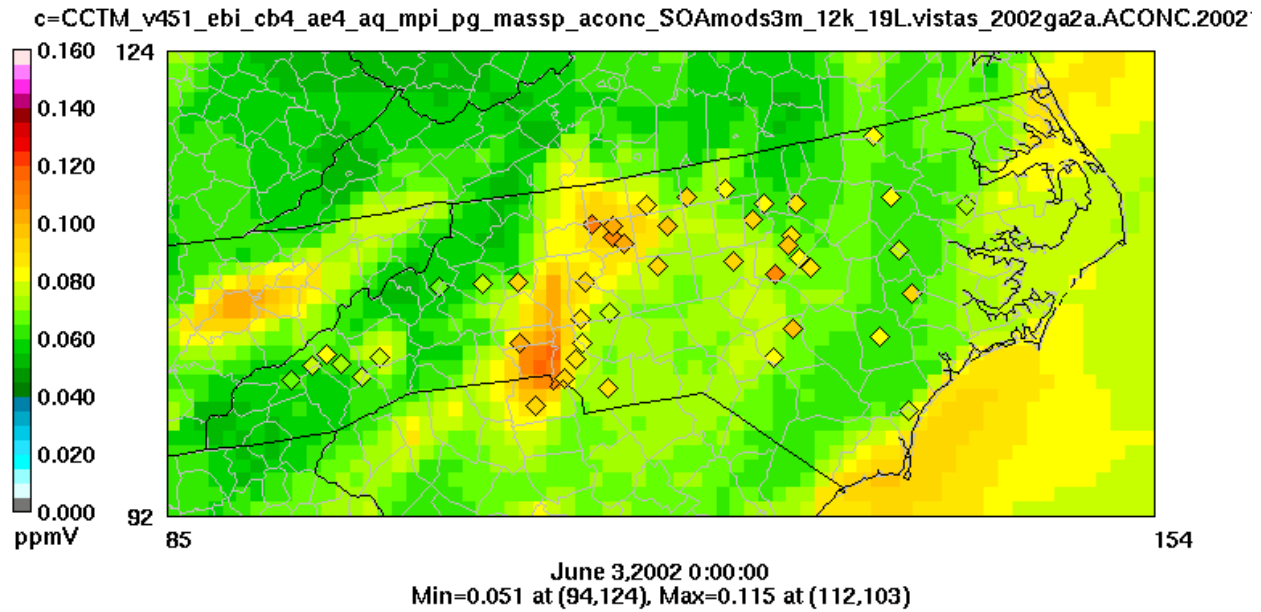


Figure III-1: Spatial plots for modeled predicted and observed peak 1-hour (top) and 8-hour (bottom) ozone concentrations for May 25, 2002.

Daily Max 1-hour Ozone



Daily Max 8-hour Ozone

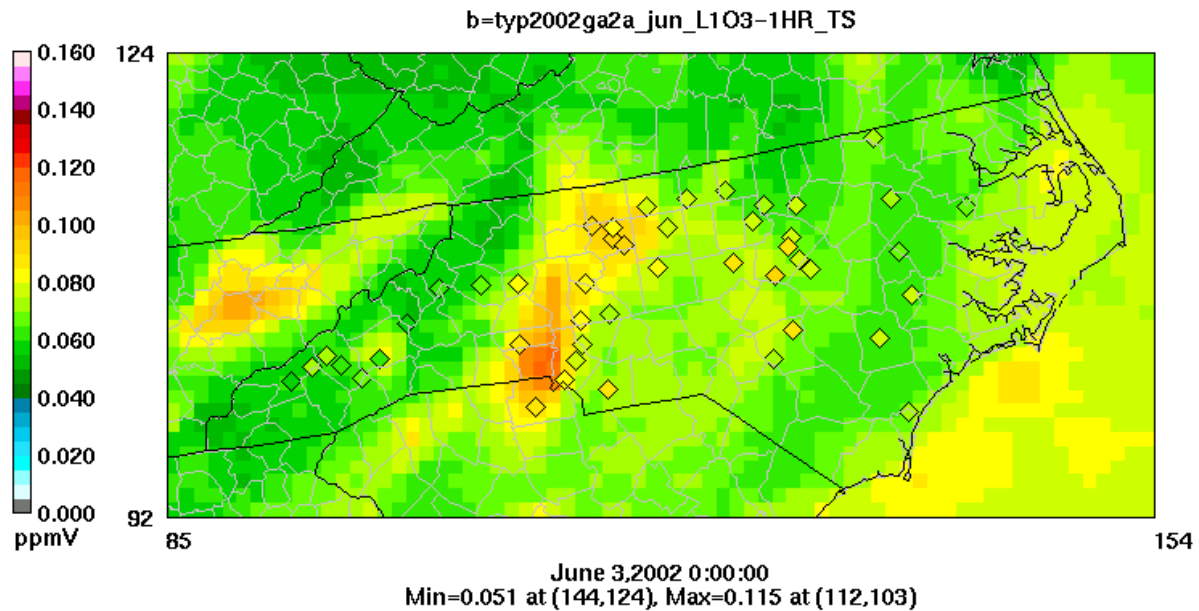
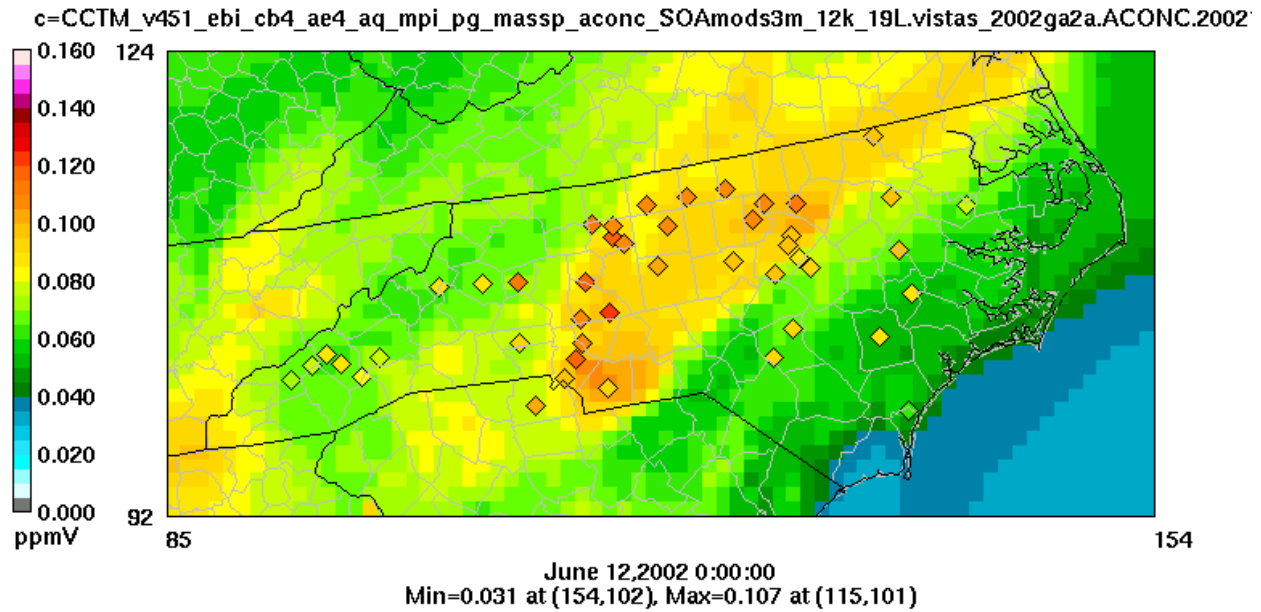


Figure III-2: Spatial plots for modeled predicted and observed peak 1-hour (top) and 8-hour (bottom) ozone concentrations for June 3, 2002.

Daily Max 1-hour Ozone



Daily Max 8-hour Ozone

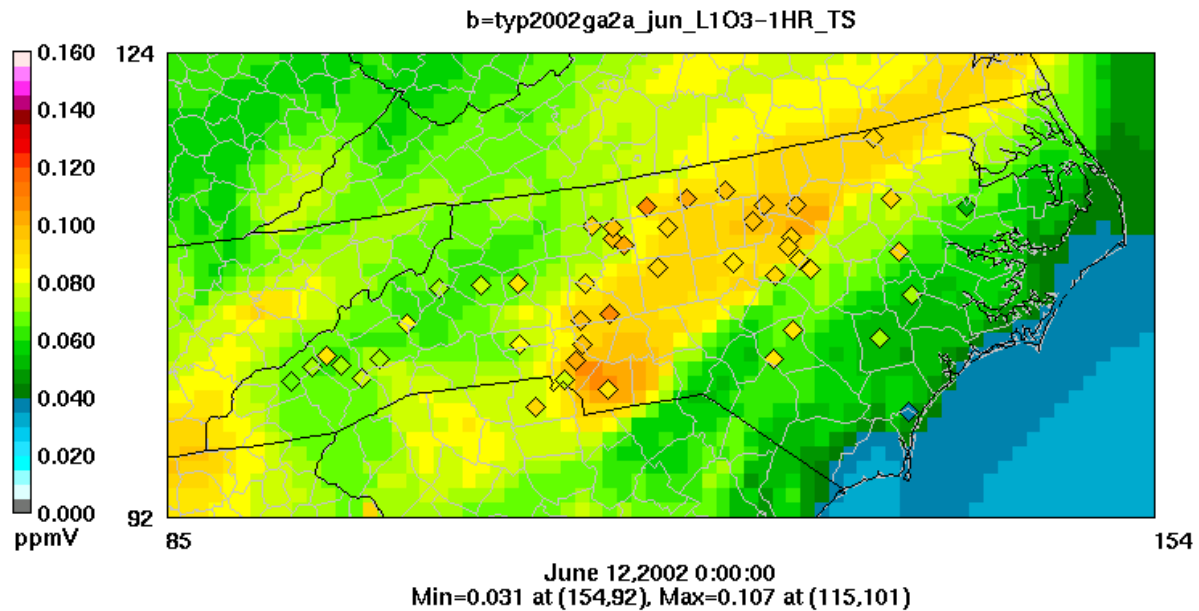
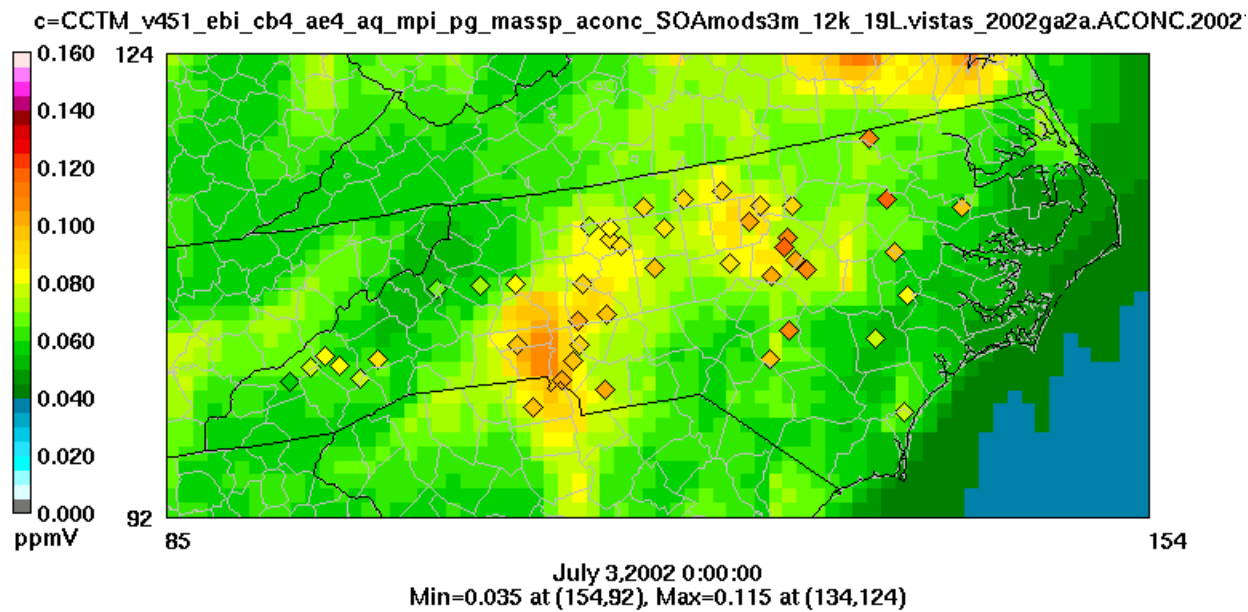


Figure III-3: Spatial plots for modeled predicted and observed peak 1-hour (top) and 8-hour (bottom) ozone concentrations for June 12, 2002.

Daily Max 1-hour Ozone



Daily Max 8-hour Ozone

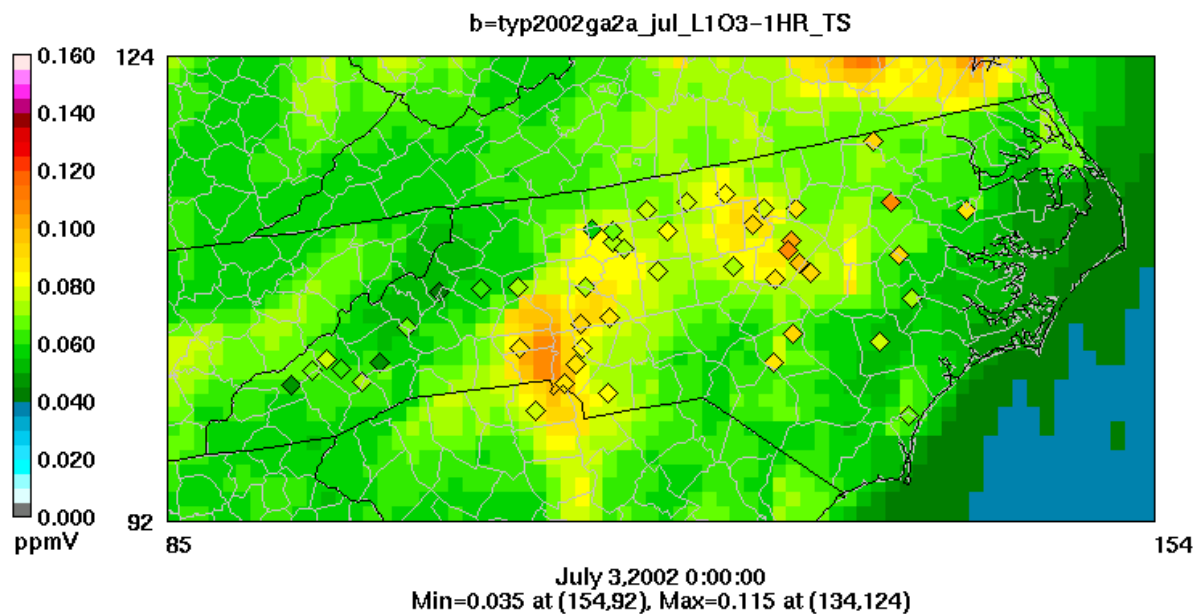
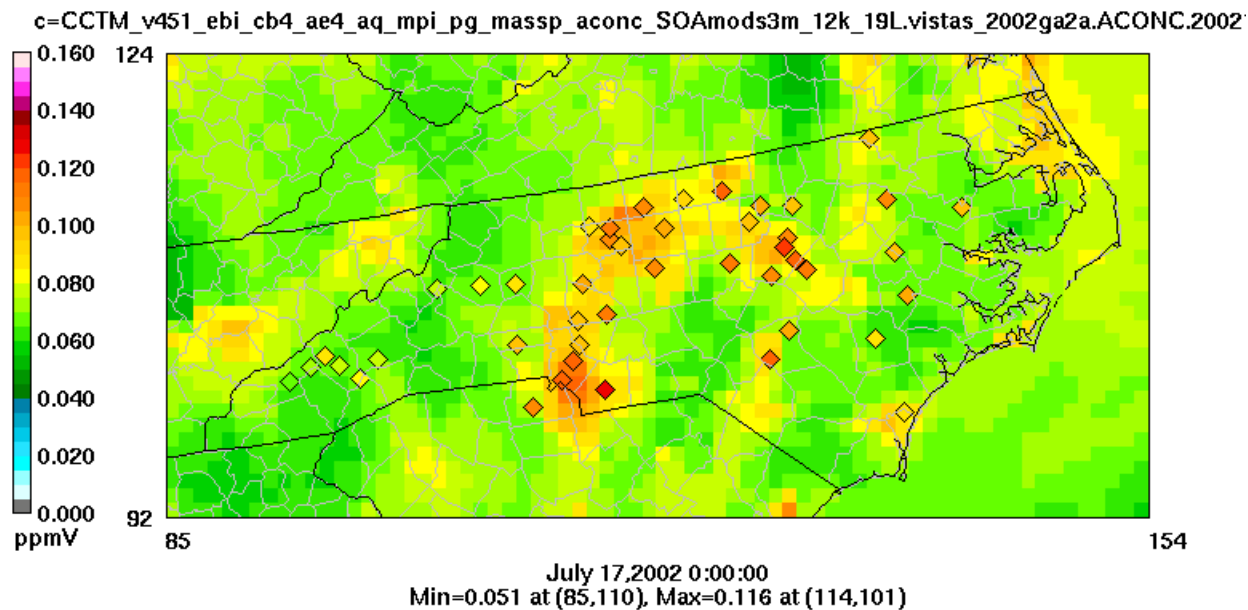


Figure III-4: Spatial plots for modeled predicted and observed peak 1-hour (top) and 8-hour (bottom) ozone concentrations for July 3, 2002.

Daily Max 1-hour Ozone



Daily Max 8-hour Ozone

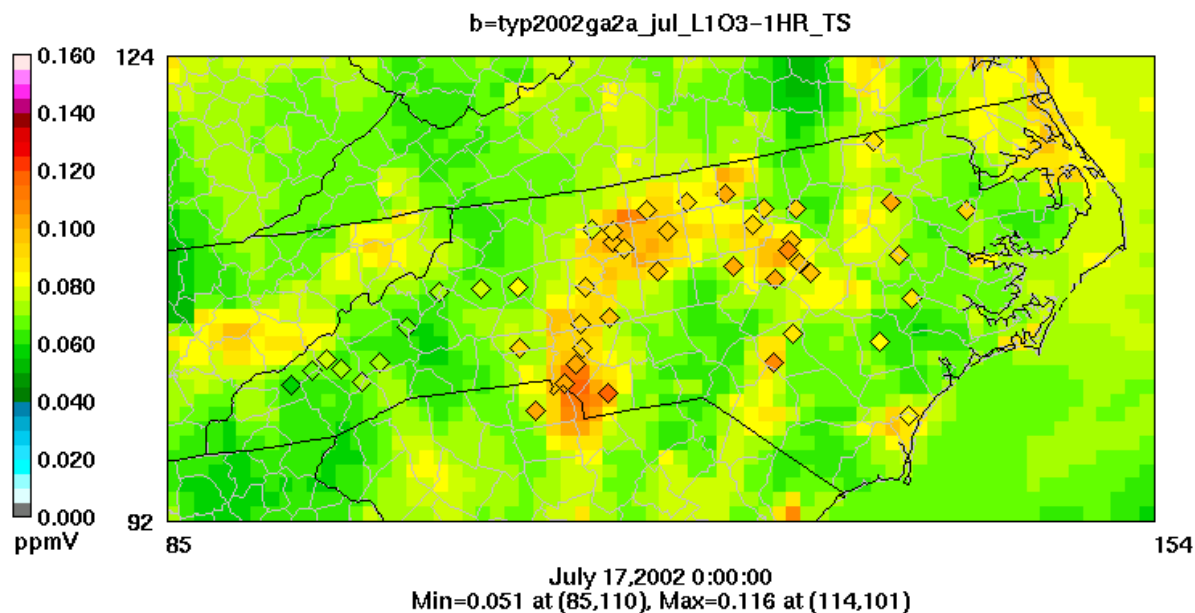
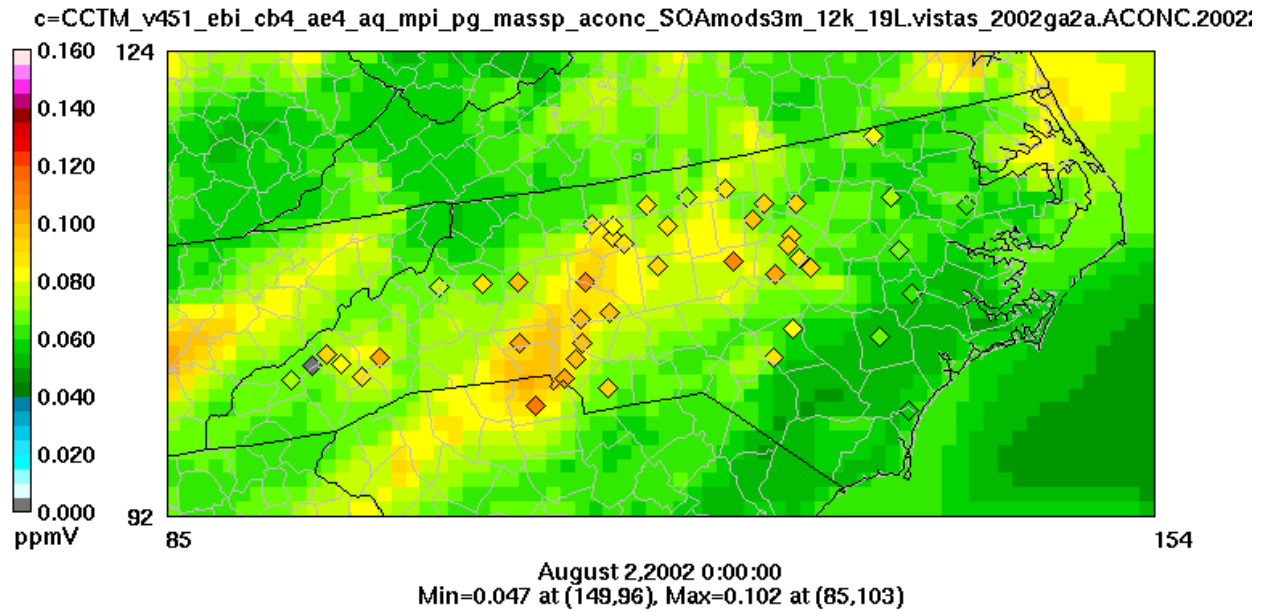


Figure III-5: Spatial plots for modeled predicted and observed peak 1-hour (top) and 8-hour (bottom) ozone concentrations for July 17, 2002.

Daily Max 1-hour Ozone



Daily Max 8-hour Ozone

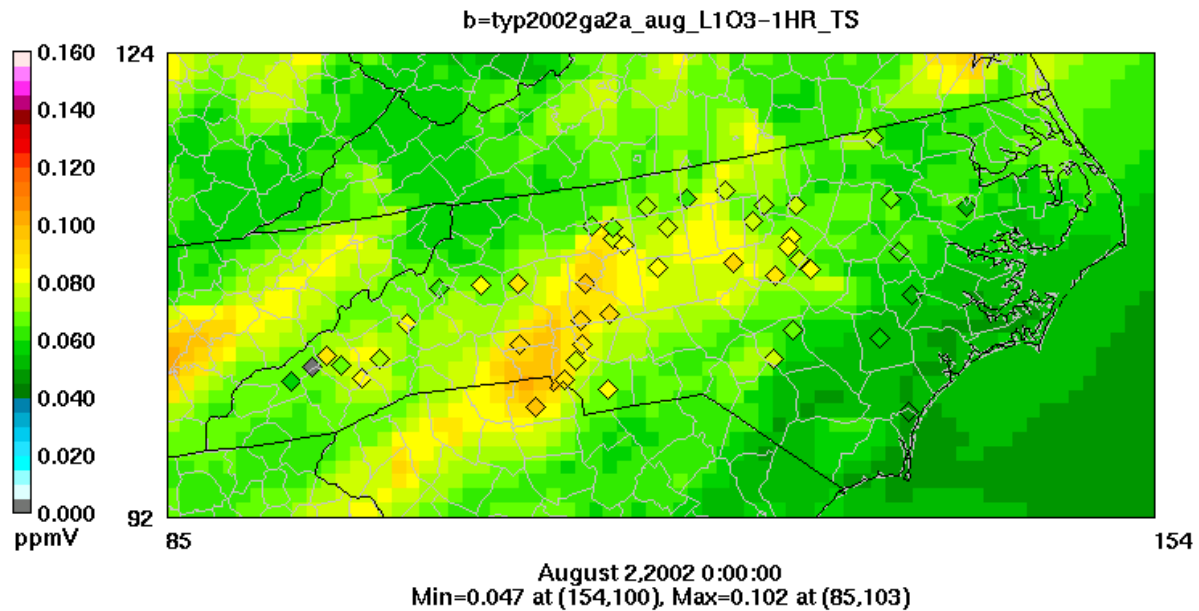
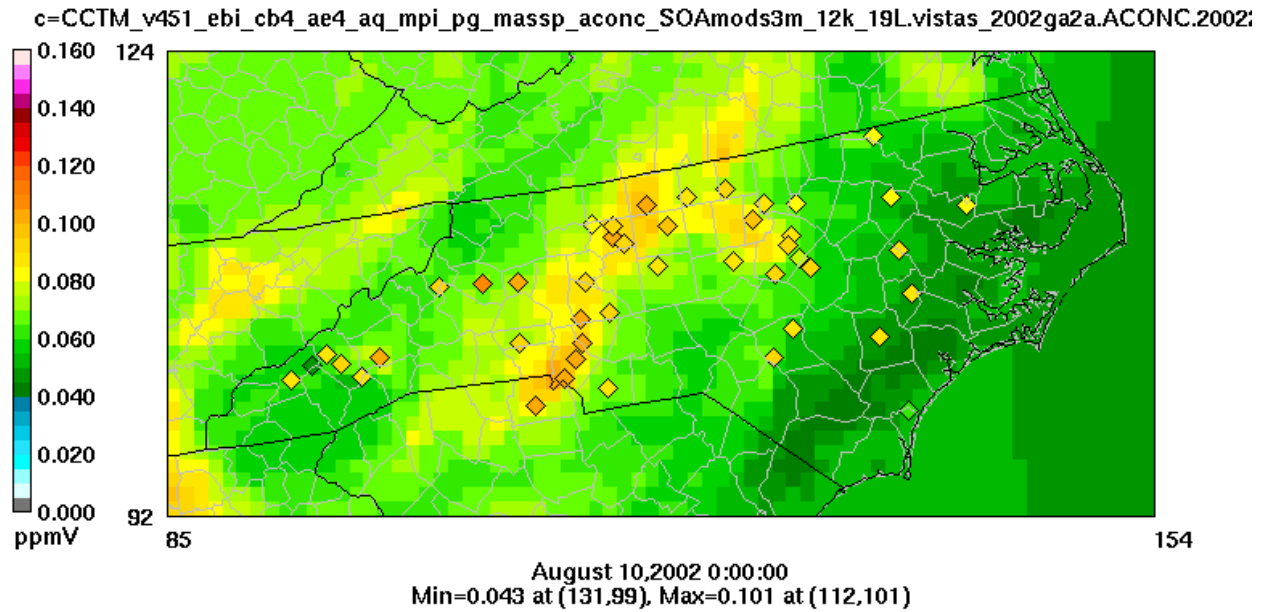


Figure III-6: Spatial plots for modeled predicted and observed peak 1-hour (top) and 8-hour (bottom) ozone concentrations for August 2, 2002.

Daily Max 1-hour Ozone



Daily Max 8-hour Ozone

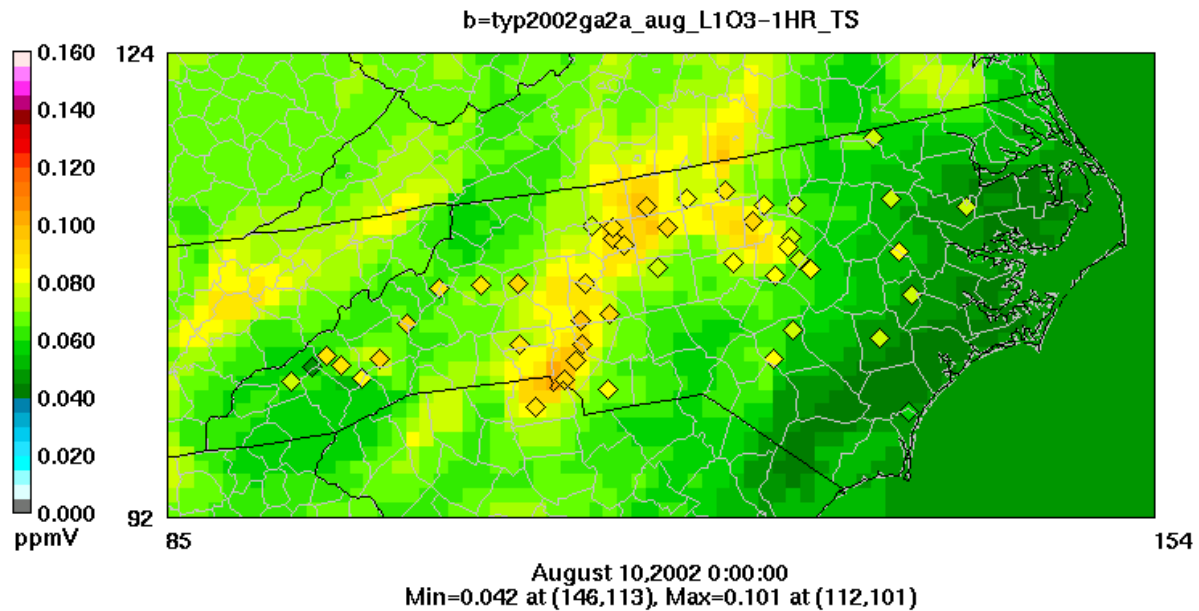


Figure III-7: Spatial plots for modeled predicted and observed peak 1-hour (top) and 8-hour (bottom) ozone concentrations for August 10, 2002.

2. Scatter Plots

SCDHEC and NCDAQ are most concerned about how the model performed for North and South Carolina, primary to the entire 12-km VISTAS/ASIP domain. For this reason, the scatter plots below are for the Carolinas only, with the domain-wide scatter plots found in Appendix J. The model performance scatter plots of "model-predicted" versus "observed" for 1-hour and 8-hour ozone have been compiled for each month used in the attainment test (May through September of 2002). Only the 8-hour ozone scatter plots for the three months (June through August), in which the majority of the modeled days used in the relative response factor, are shown. Although there are some outliers, the overall model performance was good for the 2002 ozone season, with the majority of the points falling within acceptable limits.

a. North Carolina Scatter Plots

Since the majority of the Metrolina Area is in North Carolina, scatter plots for the North Carolina domain are shown first, in Figure III-8 through Figure III-10 below. These scatter plots show 8-hour ozone for June, July, and August for all of the monitoring sites in North Carolina only (York, SC omitted). The 1-hour ozone scatter plots and the remaining 8-hour ozone scatter plots for North Carolina can be found in Appendix J. Overall, for the North Carolina monitoring sites the model performance is good. Although there are some days where over-predictions and under-predictions are observed, in general most days fall within acceptable ranges of the 1:1 line.

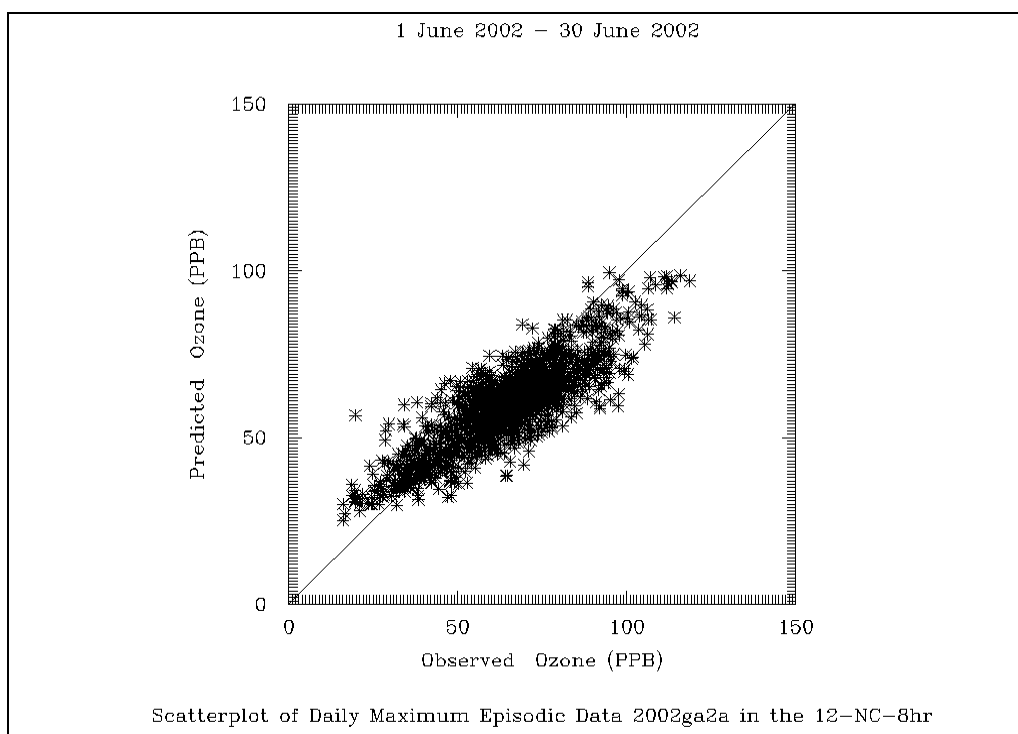


Figure III-8: 8-hour ozone scatter plot for North Carolina 12-km grid for June 2002.

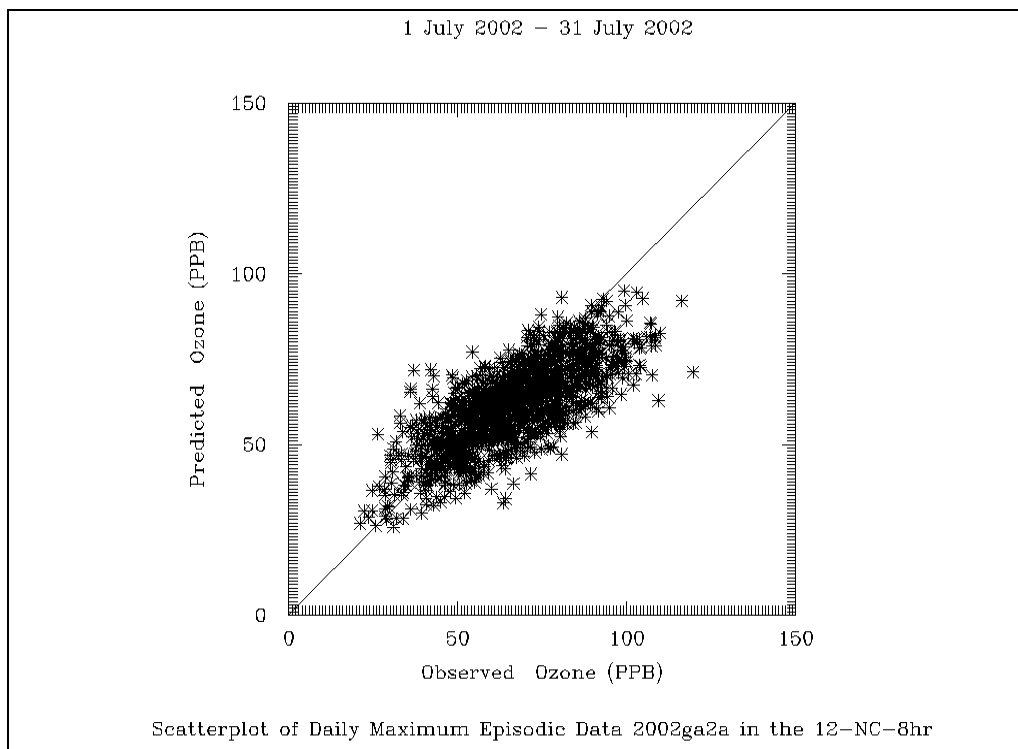


Figure III-9: 8-hour ozone scatter plots for North Carolina 12-km grid for July 2002.

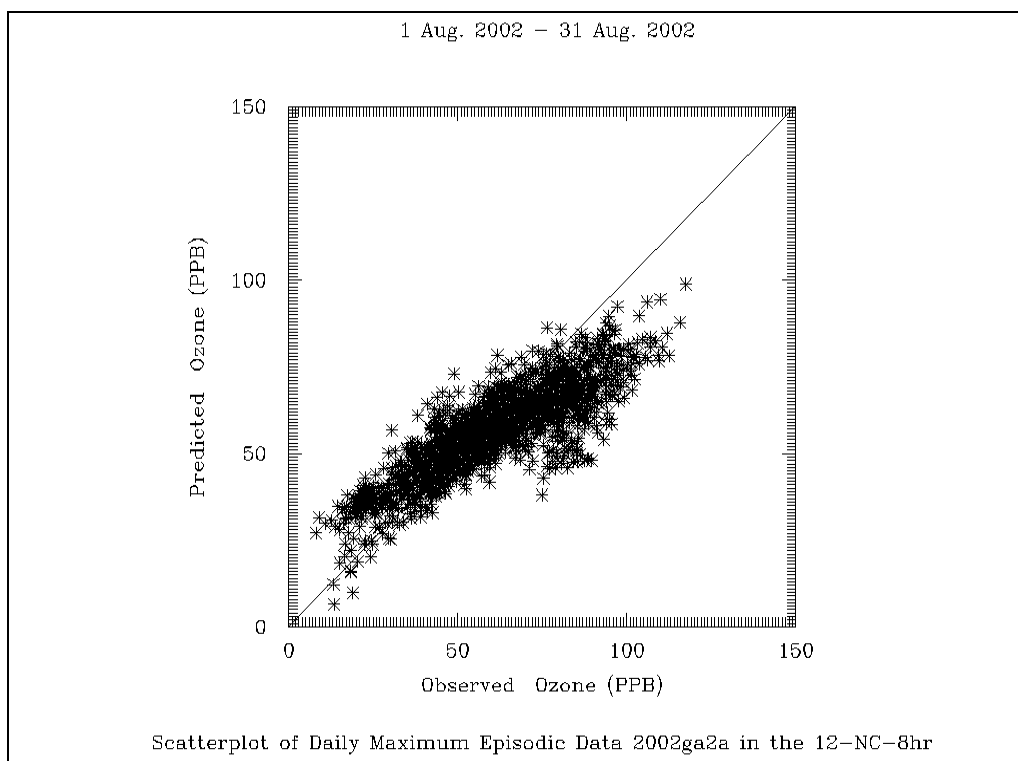


Figure III-10: 8-hour ozone scatter plots for North Carolina 12-km grid for August 2002.

b. South Carolina Scatter Plots

Figure III-11 through Figure III-13 display the scatter plots for 8-hour ozone for June, July and August for all of the monitoring sites in South Carolina (even though the York County, SC portion of the Metrolina Area is evaluated in most cases as a part of North Carolina proper). The 1-hour ozone scatter plots and the remaining 8-hour ozone scatter plots can be found in Appendix J. Overall, the model performance is good for the South Carolina monitoring sites, including York. Again, although there are some days where over-predictions and under-predictions are observed, in general most days fall within acceptable ranges of the 1:1 line.

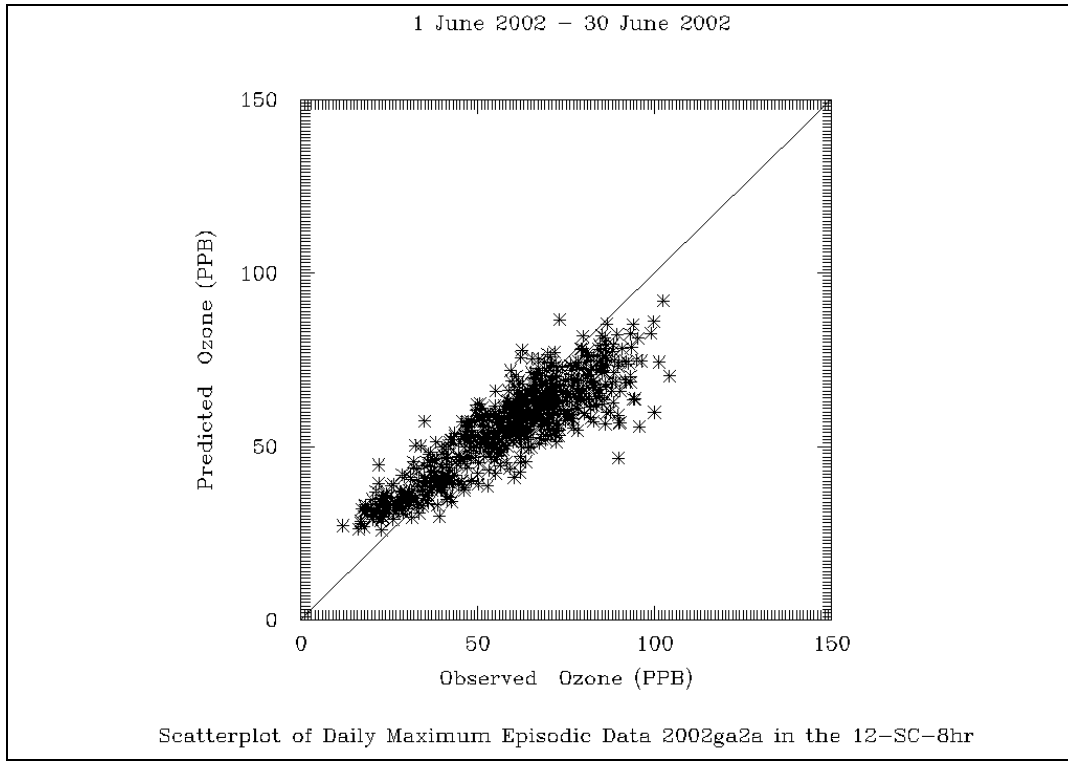


Figure III-11: 8-hour ozone scatter plots for South Carolina 12-km grid for June 2002.

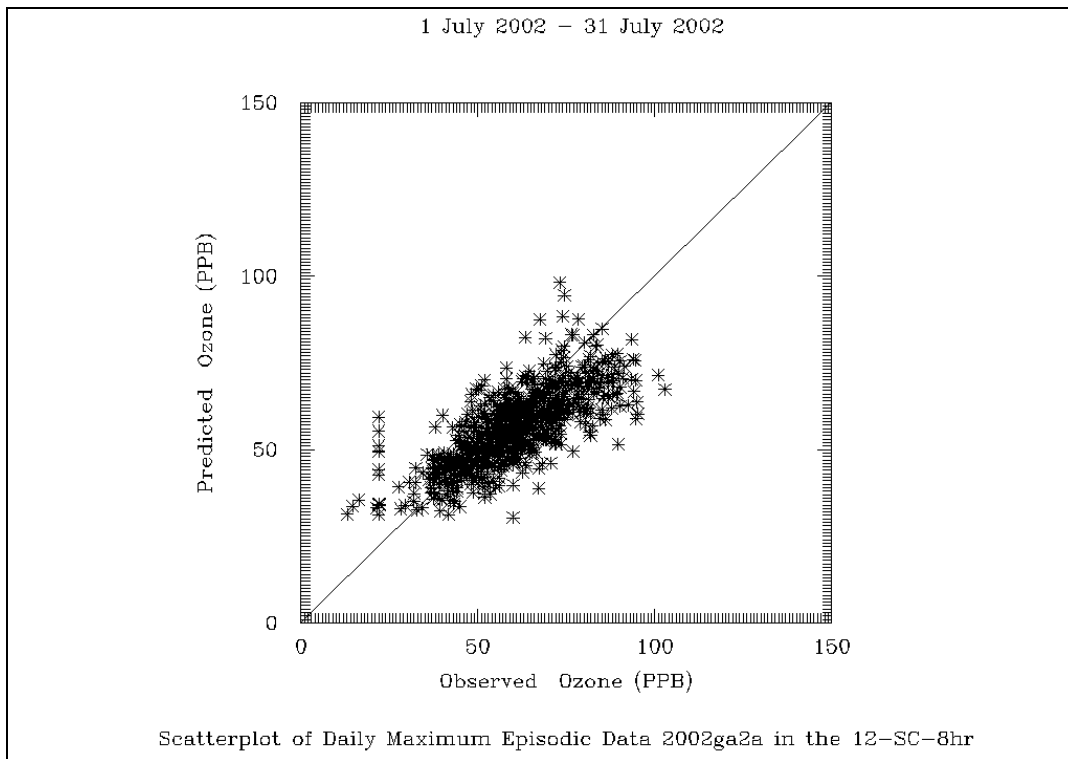


Figure III-12: 8-hour ozone scatter plots for South Carolina 12-km grid for July 2002.

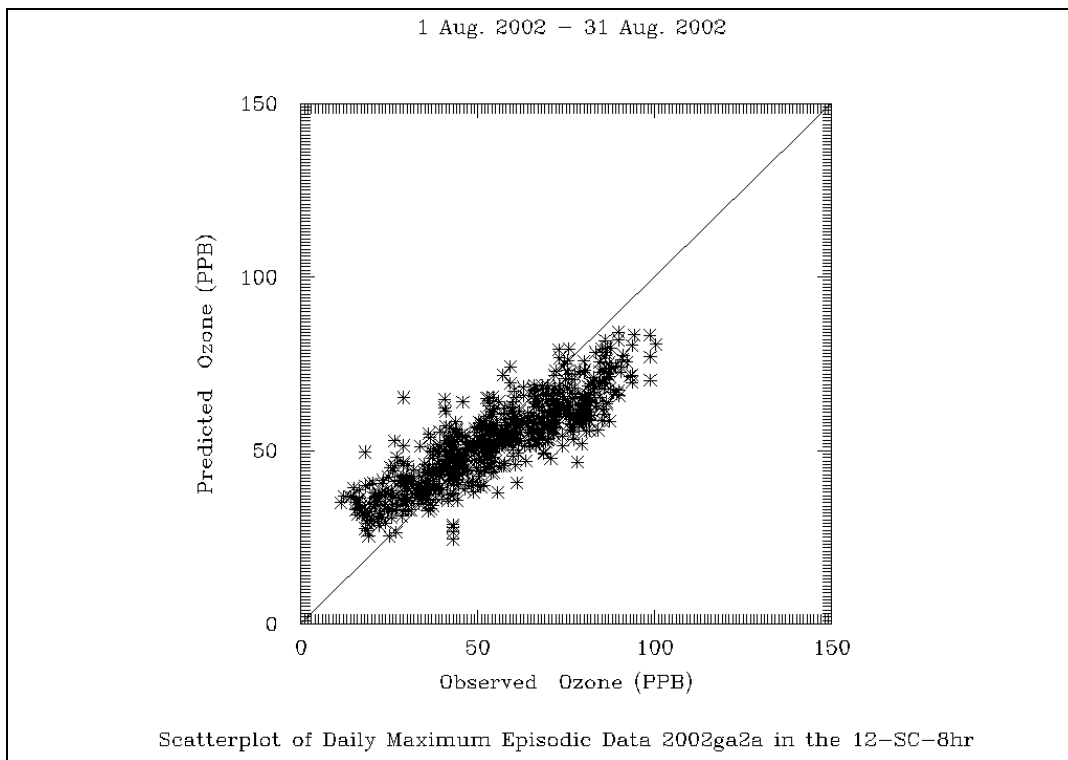


Figure III-13: 8-hour ozone scatter plots for South Carolina 12-km grid for August 2002.

3. Time Series Plots

Following are 8-hour time series plots from the 12-km domain for the North Carolina monitors for June through August. The time series presents the observed values [displayed as black asterisks (*)] and the predicted values (displayed as green lines) by month. The 1-hour and 8-hour ozone time series plots for the ASIP region, North Carolina, and South Carolina (including York) can be found in Appendix J.

The model predicts the overall diurnal pattern well; however, it tends to under-predict peak values and over-predict minimum values. In particular the last few days of August shows the model not handling the prediction of the absolute value of ozone well. Overall, the model is within acceptable tolerances for model performance.

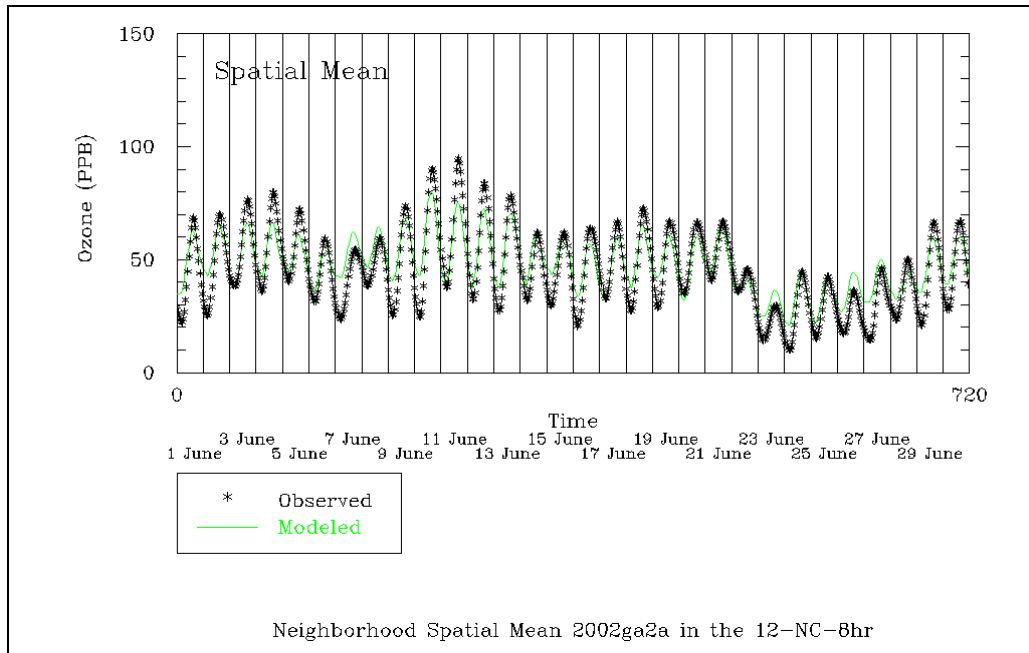


Figure III-14: Time series plot of model predicted versus mean 8-hour observed for North Carolina monitors for June 2002.

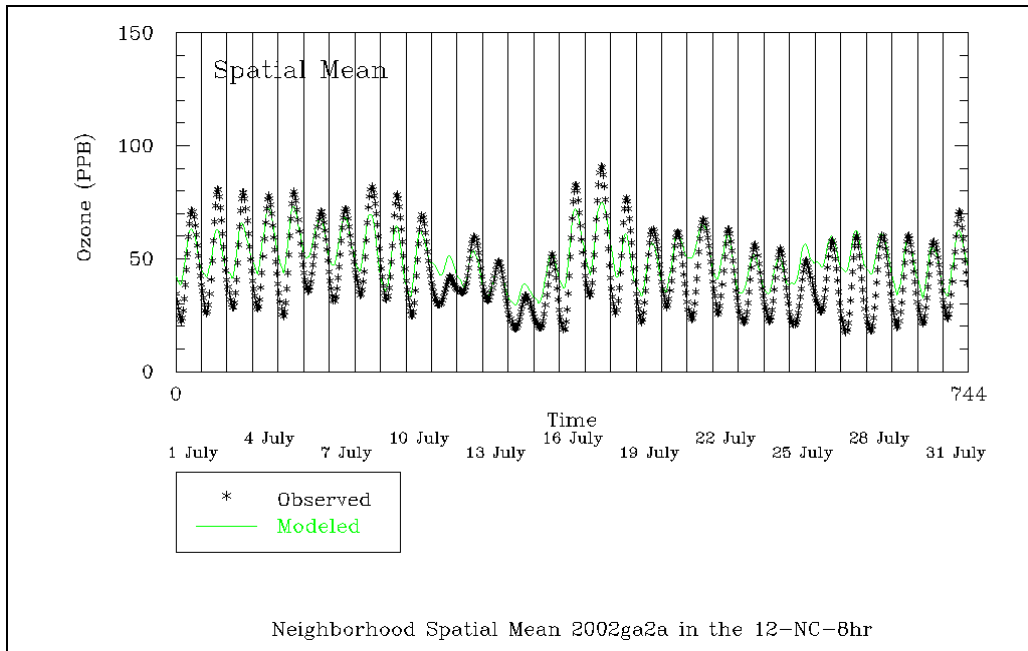


Figure III-15: Time series plot of model predicted versus mean 8-hour observed for North Carolina monitors for July 2002.

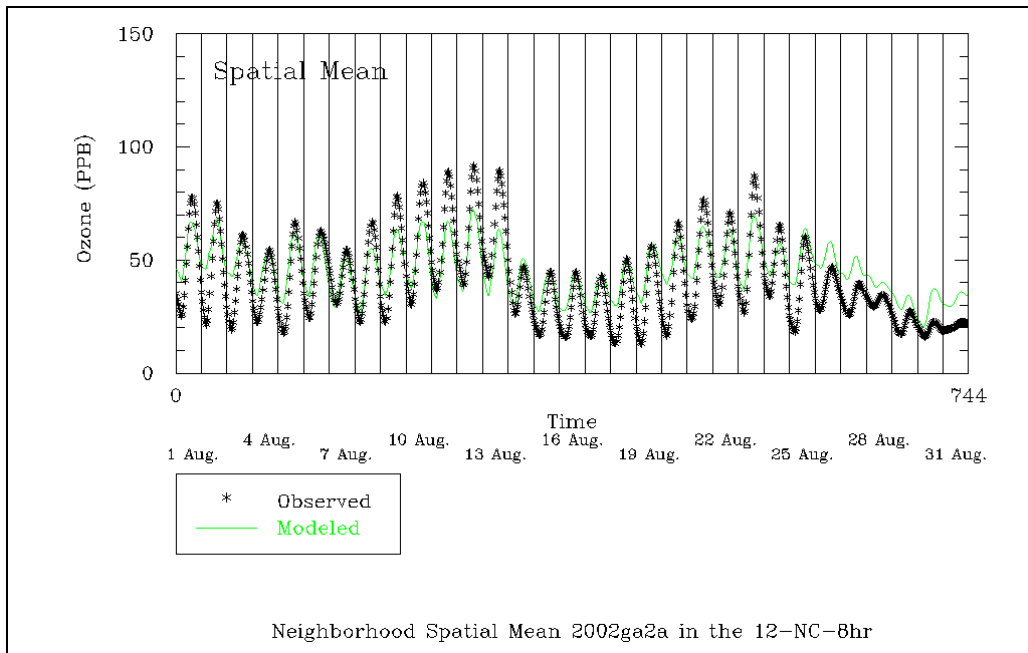


Figure III-16: Times series plot of model predicted versus mean 8-hour observed for North Carolina monitors for August 2002

4. Domain-Wide Summary

Overall, SCDHEC believes that the VISTAS/ASIP CMAQ model performance across the domain

and throughout the ozone season is good. For the most part, mean normalized bias and mean normalized gross error fall within the recommended limits for good model performance. The model seems to do a good job capturing ozone concentrations through various episode ramp-up and clean-out cycles. There are some instances of under- and over-predictions, but, as the scatter plots show, most of the time, the model does well simulating the afternoon ozone peak throughout the Carolinas.. SCDHEC believes that the model performance is well within the limits of acceptable performance established in USEPA's *Guidance On The Use Of Models And Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze* ("Attainment Guidance") and produces results reliable enough for use in the Metrolina Area attainment demonstration.

B. Area and Monitor Statistics

Table III-2 displays the model performance statistics comparing the modeled 8-hour ozone mean and the observed 8-hour ozone mean at each monitor in the Metrolina area, as well as the combined statistics for all of the monitors in the Metrolina area. The statistics represent the May through September ("core ozone season") time period.

Table III-2: Metrolina Nonattainment Area Monitor Statistics

Monitor	Modeled Mean (ppb)	Observed Mean (ppb)	Mean Bias (ppb)	Mean Normalized Bias (%)	Mean Normalized Gross Error (%)
Metrolina Area	65.25	73.00	-7.875	-10.152	13.289
Crouse	69.0	73.0	-4.0	-5.330	9.868
County Line	67.0	74.0	-7.0	-8.807	11.885
Garinger (Plaza)	63.0	73.0	-11.0	-14.470	16.125
Arrowood	67.0	72.0	-5.0	-5.837	12.249
Enochville	65.0	75.0	-9.0	-11.790	13.710
Rockwell	65.0	73.0	-9.0	-10.989	13.322
Monroe	62.0	72.0	-10.0	-13.097	14.958
York County, SC	64.0	72.0	-8.0	-10.898	14.197

USEPA recommends that the combined mean normalized bias fall within ± 5 -15 percent and the combined mean normalized gross error not exceed the 30-35 percent range. For a specific monitor, it is recommended that the mean normalized bias fall within ± 20 percent. The table above shows the VISTAS/ASIP CMAQ modeling demonstrated that the mean bias, mean normalized bias, and mean normalized gross error were all within recommended and accepted ranges.

A slight under-prediction of 8-hour ozone was also observed at this more refined level of analysis and was similar to what was seen at the larger state and VISTAS/ASIP region levels. Individual monthly statistics are not presented here due to the very limited number of modeled and observed data pairs at only the eight Metrolina Area ozone monitoring sites. Whole season statistics are more representative of how this air quality modeling will be applied in the modeled attainment test discussed in Appendix L. Across the whole season, the Metrolina Area as a whole, as well as the individual ozone monitoring sites, showed a mean normalized bias within the suggested ± 5 -15 percent range. Additionally, mean normalized gross error fell within the suggested 30-35 percent range given a 60 ppb threshold.

SECTION IV. CONTROLS APPLIED

Several control measures already in place or being implemented over the next few years will reduce stationary point, highway mobile, and nonroad mobile sources emissions. The Federal and State control measures were modeled for all of the future years and are discussed in the sections below.

A. Federal Control Measures

1. Tier 2 Vehicle Standards

Federal Tier 2 vehicle standards will require all passenger vehicles in a manufacturer's fleet, including light-duty trucks and Sport Utility Vehicles (SUVs), to meet an average standard of 0.07 grams of NO_x per mile. Implementation began in 2004, and should be completely phased in by 2007. The Tier 2 standards will also cover passenger vehicles over 8,500 pounds gross vehicle weight rating (the larger pickup trucks and SUVs), which are not covered by the current Tier 1 regulations. For these vehicles, the standards will be phased in beginning in 2008, with full compliance in 2009. The new standards require vehicles to be 77% to 95% cleaner than those on the road today. The Tier 2 rule also reduced the sulfur content of gasoline to 30 ppm starting in January of 2006. Most gasoline sold in South Carolina prior to January 2006 had a sulfur content of about 300 ppm. Sulfur occurs naturally in gasoline but interferes with the operation of catalytic converters on vehicles, resulting in higher NO_x emissions. Lower-sulfur gasoline is necessary to achieve the Tier 2 vehicle emission standards.

2. Heavy-Duty Gasoline and Diesel Highway Vehicles Standards

New USEPA standards designed to reduce NO_x and VOC emissions from heavy-duty gasoline and diesel highway vehicles commenced implementation in 2004. A second phase of standards and testing procedures, which begins in 2007, is reducing particulate matter from heavy-duty highway engines and has reduced highway diesel fuel sulfur content to 15 ppm. The total program for these new engines using low sulfur diesel is expected to achieve a 90% reduction in particulate matter (PM) emissions and a 95% reduction in NO_x emissions (as compared to existing engines using higher-content sulfur diesel).

3. Large Nonroad Diesel Engines Rule

In May 2004, USEPA promulgated new rules for large nonroad diesel engines (such as those used in construction, agricultural, and industrial equipment) to be phased in between 2008 and 2014. The nonroad diesel rules also reduce the allowable sulfur in nonroad diesel fuel by over 99%. Nonroad diesel fuel currently averages about 3,400 ppm sulfur. The rule limits nonroad diesel sulfur content to 500 ppm in 2006 and 15 ppm in 2010. The combined engine and fuel rules would reduce NO_x and PM emissions from large nonroad diesel engines by over 90% (as compared to current nonroad engines using higher-content sulfur diesel).

4. Nonroad Spark-Ignition Engines and Recreational Engines Standard

The new standard, effective in July 2003, regulates NO_x, HC, and CO for groups of previously unregulated nonroad engines. The new standard will apply to all new engines imported into or sold within the United States after these standards begin and will apply to large spark-ignition engines (forklifts and airport ground service equipment), recreational vehicles (off-highway motorcycles and all-terrain-vehicles), and recreational marine diesel engines. The regulation varies based upon the type of engine or vehicle.

The large spark-ignition engines contribute to ozone formation and ambient CO and PM levels in urban areas. Tier 1 of this standard was implemented in 2004, and Tier 2 is scheduled to start in 2007. Like the large spark-ignition, recreational vehicles contribute to ozone formation and ambient CO and PM levels. For all model-year 2006 off-highway motorcycles and all-terrain-vehicles, the new exhaust emissions standard was phased-in at 50%; for model years 2007 and later, the standard will be phased-in at 100%. Recreational marine diesel engines over 37 kilowatts (used in yachts, cruisers, and other types of pleasure craft) contribute to ozone formation and PM levels, especially in marinas. For certain recreational marine diesel engine sizes, the standard began to be phased-in in 2006.

When all of the nonroad spark-ignition engines and recreational engines standards are fully implemented, overall reductions of 72% in HC, 80% in NO_x, and 56% in CO emissions are expected by 2020. These controls will help reduce ambient concentrations of ozone, CO, and fine PM.

SECTION V. ATTAINMENT DEMONSTRATION

A. Attainment Test Introduction

The modeled attainment test is the practice of using air quality modeling results for baseline and future years to determine if an area is expected to attain the NAAQS. For the 8-hour ozone NAAQS, the baseline and future model estimates are used in a "relative" rather than an "absolute" sense. Specifically, the ratio of the air quality model's future to current predictions is calculated at each ozone monitoring site. These monitoring site-specific ratios are called relative response factors (RRFs). Future ozone design values (DVF) are then estimated at each monitor by multiplying the monitor-specific baseline ozone design value (DVB) by the modeled RRF for each monitor. If all of the predicted monitor-specific DVFs in a given area are less than or equal to 0.084 ppm, the attainment test is passed and the area is said to demonstrate attainment. Equation V-1 presents the modeled attainment test, applied at monitoring site "x" as described in Section 4.0 of USEPA's *Attainment Guidance*.

Equation V-1 (Future Design Values):

$$(DVF) = (RRF) \times (DVB)$$

Where:

(DVB) = the baseline design value monitored at site "x" in ppm
= the average of the three design value periods which include the baseline inventory year (i.e., the average of the 2000-2002, 2001-2003, and 2002-2004 design value periods for the 2002 baseline inventory year).

(RRF) = the ratio of the future 8-hr daily maximum concentration predicted "nearby" a monitor (averaged over each day of the episode) to the current 8-hr daily maximum concentration predicted "nearby" the monitor (averaged over each day of the episode).

(DVF) = the estimated future design value in ppm.

It is important to consider an array of cells "nearby" a monitor rather than focusing on the individual cell containing the monitor. This allows for variations in the model performance where the peak ozone concentration occurs in a nearby grid cell rather than in the grid cell that contains the monitor.

The RRF is calculated by taking the ratio of the mean future year modeling 8-hour ozone daily maximum (averaged over all of the episode days) to the mean current year modeling 8-hour ozone daily maximum "near" the monitor (averaged over all of the episode days) (Equation V-2).

Equation V-2 (Relative Response Factors):

$$RRF = \frac{(\text{mean future yr. 8-hr daily max "near" monitor "x"})}{(\text{mean current yr. 8-hr daily max "near" monitor "x"})}$$

The DVB, for purposes of the modeled attainment test, is defined in USEPA's *Attainment Guidance* as the average of the three design value periods that straddle the baseline inventory year (i.e., the average

of the 2000-2002, 2001-2003, and 2002-2004 design value periods for a 2002 baseline inventory year).

B. Attainment Test Results

As stated above, the attainment test is not based on absolute modeling results but, rather, relative reductions of ozone and is only applied at the monitors. However, reviewing the modeling results of how the predicted ozone decreases in the future years and how widespread the reductions are plays an important role for the State in determining if additional controls should be considered. The modeling results for each day used in the RRF calculations are available in Appendix K. Additionally, discussions about how this modeling demonstration meets the screening test for areas away from the monitoring sites and additional matrices performed to support the attainment test results are in Appendix L.

USEPA's *Attainment Guidance* states that future design values (DVs) that fall below 0.082 ppm demonstrate attainment whereby little weight of evidence is needed. For monitors with DVs between 0.082 ppm and 0.087 ppm, weight of evidence must be submitted that supports a demonstration of attainment. DVs greater than 0.087 ppm fail the attainment test.

Table V-1 lists the attainment test results for the Metrolina nonattainment area. The first column is the monitoring site, followed by the base year design value discussed in Section V.A. The next series of columns are the calculated RRF and the resulting DVF for the 2009 attainment year. Monitors with DVs that fall in the additional weight of evidence requirement appear in bold.

Table V-1: Attainment Test Results

Monitoring Site	County	DVB (ppm) 5-year weighted 2000-2004	2009	
			RRF	DVF (ppm)
Arrowood	Mecklenburg	0.0847	0.892	0.075
County Line	Mecklenburg	0.0973	0.874	0.085
Crouse	Lincoln	0.0907	0.868	0.078
Enochville	Rowan	0.0970	0.870	0.084
Garinger (Plaza)	Mecklenburg	0.0953	0.883	0.084
Monroe	Union	0.0870	0.884	0.076
Rockwell	Rowan	0.0973	0.862	0.083
York	York, SC	0.0830	0.861	0.071

C. Supporting Weight of Evidence

As part of the weight of evidence determination, the following analyses will be evaluated: alternative DVF calculations, additional metrics of air quality modeling results, air quality modeling results from other studies, positive trends in observed air quality and additional emissions reductions, and local measures that were not modeled. The weight of evidence determination is a supplement to the modeled attainment test and further supports that the area will attain the NAAQS for 8-hour ozone by June 15, 2010.

SCDHEC believes that the weight of evidence provided in the sections below is strong evidence that the Metrolina nonattainment area will attain the 8-hour ozone NAAQS by 2009.

1. Alternative DVF Calculation

USEPA recommends calculating the DVB by averaging the three design value periods that straddle the baseline inventory year. This methodology results in a center weighting of annual 4th highest ozone concentrations around the baseline inventory year because the three design value periods averaged contain overlapping data. A weighted DVB can be significantly affected by an abnormally hot/dry or cool/wet year, if the year happens to be the center weighted year.

To minimize potential impacts of any abnormal meteorological conditions while still considering ozone conditions across a 5-year span, NCDAQ and SCDHEC prefer an alternative DVB calculation that does not weigh any of the years more than another but is the straight average of annual 4th highest ozone concentrations for the 5-year span centered on the baseline inventory year.

This preferred DVB calculation is applied to the remainder of the modeled attainment test equations and the resulting DVFs are shown in Table V-2 at each monitoring site in the Metrolina region.

Table V-2: 5-Year Average Alternative Attainment Test Results for 2009

Monitoring Site	County	DVB 5-Year Straight Average 2000-2004 (ppm)	RRF	DVF (ppm)
Arrowood	Mecklenburg	0.0834	0.892	0.074
County Line	Mecklenburg	0.0956	0.874	0.083
Crouse	Lincoln	0.0892	0.868	0.077
Enochville	Rowan	0.0944	0.870	0.082
Garinger (Plaza)	Mecklenburg	0.0938	0.883	0.082
Monroe	Union	0.0846	0.884	0.074
Rockwell	Rowan	0.0946	0.862	0.081
York	York, SC	0.0798	0.861	0.068

The alternative DVFs are slightly lower at each monitoring site compared to the attainment test DVFs. These differences were expected as 2002 was an abnormally hot and dry year throughout the Southeast, resulting in ozone concentrations that were higher than normal and that were much higher than in the surrounding years of 2000, 2001, 2003, and 2004. Thus, USEPA recommended DVB calculation weighted these abnormally-high air quality conditions several times more than in the straight average alternative DVB calculations. The NCDAQ and SCDHEC firmly believe that the straight five-year average approach to the DVB calculation is more appropriate and minimizes dramatic fluctuations in meteorological and air quality conditions from year to year.

While none of the monitoring sites in the Metrolina region had DVF values at or above 0.085 ppm using the straight average alternative DVB calculation, there are still three monitors that have DVFs that fall between 0.082 and 0.087 ppm. This continues to indicate that some additional weight of evidence should be included to demonstrate attainment.

2. Additional Air Quality Modeling Metrics

A series of five additional air quality modeling outputs or metrics is recommended to provide assurance the modeled attainment demonstration indicates attainment. These metrics look at the relative change between the baseline and future years modeling and help to demonstrate how widespread the improvement in air quality is expected in the future. These metrics include:

- The relative change in surface grid-hours greater than 0.084ppm. This is the number of grid cells in a Metrolina region with predicted hourly 8-hour ozone concentrations greater than 0.084 ppm. The relative change is the percent reduction from the baseline year to the future year.
- The relative change in the number of grid cells with predicted 8-hour daily maximums greater than 0.084 ppm. This metric uses the modeled daily maximum 8-hour ozone concentrations greater than 0.084 ppm. The relative change is the percent reduction from the baseline year to the future year.
- The relative change in the sum of hourly predictions greater than 0.084 ppm. This metric is the sum of all grid cells with predicted hourly 8-hour ozone concentrations greater than 0.084 ppm. The relative change is the percent reduction from the baseline year to the future year.
- The relative change in the sum of the predicted 8-hour daily maximums greater than 0.084 ppm. This metric uses the modeled daily maximum 8-hour ozone concentrations greater than 0.084 ppm. The relative change is the percent reduction from the baseline year to the future year.
- The change in the Air Quality Index (AQI) counts. The AQI counts metric is a count of the number of grid cells with predicted maximum 8-hour ozone concentrations sorted within each of the color codes as defined by USEPA's AQI.

USEPA recommended that these metrics should indicate a reduction in ozone of 80% or more in order to provide weight of evidence that an area would attain the ozone NAAQS. The additional air quality modeling metric analyses demonstrated reductions of greater than 85% for all metrics in the 2009 attainment year for modeled days above the NAAQS in the Metrolina nonattainment area. A full discussion of the metrics and the results can be found in Appendix L.

3. Air Quality Modeling Results From Other Studies

Another recommended weight of evidence analysis is to review other air quality modeling results that included the Metrolina nonattainment area to determine how other modeling results compare to the attainment demonstration. There are two air quality modeling studies for which results are available for the Metrolina area.

The first is the Early Action Compact (EAC) modeling that the NCDAQ and SCDHEC performed for the EAC areas within North and South Carolina. Since the modeling domain for this analysis covered the majority of North and South Carolina, including the Metrolina nonattainment area, the modeling results can be easily compared to the attainment demonstration. Although there are some differences between the two modeling exercises, the modeling results for 2012 show all of the monitors well below the 8-hour ozone NAAQS, with the highest monitor having a DVF of 0.081 ppm.

Table V-3: Metrolina DVFs Based on EAC Modeling

Monitoring Site	County	DVB (ppm)	2012	
			RRF	DVF (ppm)
Arrowood	Mecklenburg	0.092	0.848	0.078
County Line	Mecklenburg	0.101	0.802	0.081
Crouse	Lincoln	0.092	0.826	0.076
Enochville	Rowan	0.099	0.818	0.081
Garinger (Plaza)	Mecklenburg	0.098	0.816	0.080
Monroe	Union	0.088	0.795	0.070
Rockwell	Rowan	0.100	0.800	0.080
York	York, SC	0.086	0.844	0.073

Another air quality modeling exercise that contained results for the Metrolina nonattainment area is USEPA's modeling for the Clean Air Interstate Rule (CAIR). The Technical Support Document for the final CAIR, dated March 2005, provided modeling results with and without the implementation for the CAIR. These modeling results are listed in the table below.

Table V-4: Metrolina DVFs Based on USEPA's CAIR Modeling

County	DVB (ppb)	DVF (ppb)	
		2010 Base	2010 CAIR
Lincoln	92.3	76.1	74.5
Mecklenburg	100.3	82.5	81.4
Rowan	99.7	81.3	80.1
Union	87.7	71.9	71.1
York, SC	83.3	70.0	68.5

USEPA's modeling results predicts that the Metrolina nonattainment area should be below the 8-hour ozone standard by 2010. Although this is one year later than the attainment year for the Metrolina area, USEPA's 2010 CAIR DVFs are 2 to 4 ppb lower than the DVFs predicted in the attainment demonstration and support weight of evidence that the Metrolina area will attain the 8-hour ozone standard by its attainment year of 2009.

4. Positive Trends in Observed Air Quality and Additional Emissions Reductions

Since the 8-hour ozone designation for the Metrolina area, the 8-hour ozone design values have improved significantly. The 2001-2003 design value period had values as high as 0.100 ppm, and six out of the seven North Carolina monitors in the area were violating the NAAQS. Each year since, the design values have decreased and/or the number of violating monitors in the region has decreased. For the latest design value period, 2004-2006, the highest violating monitor has a value of 88 ppb, with only three monitors exceeding the NAAQS (See Table V-5)

Table V-5: Design Values (ppm) for the North Carolina Monitors in the Metrolina Area

Monitoring Site	County	2001-2003	2002-2004	2003-2005	2004-2006
Arrowood	Mecklenburg	0.084	0.081	0.078	0.080
County Line	Mecklenburg	0.098	0.092	0.087	0.088
Crouse	Lincoln	0.092	0.086	0.081	0.079
Enochville	Rowan	0.099	0.091	0.085	0.085
Garinger (Plaza)	Mecklenburg	0.096	0.091	0.086	0.088
Monroe	Union	0.088	0.085	0.079	0.078
Rockwell	Rowan	0.100	0.094	0.088	0.083
York	York, SC	0.084	0.081	0.075	0.076

There are still significant nitrogen oxides (NO_x) emission reductions that are expected between now and the attainment year. It is estimated that there will be approximately 7.6 tons per day of NO_x emissions reduced each year from the mobile sector. These reductions are the result of Federal motor vehicle and equipment standards for both highway vehicles and off-road equipment.

The utility sector is another source of NO_x emission reductions that are expected to occur between now and the attainment year. Several of the Duke Energy units are expected to have controls installed over the next two years. Table V-6 lists the units that are in and around the Metrolina area, listing the year the controls are expected to come on-line and the estimated amount of NO_x emissions reductions for the ozone season.

Table V-6: Utility NO_x Emission Reductions since 2006 Ozone Season

Facility	County	Technology	Operational Date	Ozone Season Reductions (tons/season)
Allen Steam Station Unit 2 Unit 3	Gaston	SNCR SNCR	Spring 2007 Fall 2007	~300
Buck Steam Station Units 3 & 4 Units 5 & 6	Rowan	Low NO _x Burners SNCR	Spring 2007 Fall 2006	~350
Riverbend Unit 4 Unit 5 Unit 6 Unit 7	Gaston	SNCR SNCR & Burners SNCR & Burners SNCR	Spring 2007 Spring 2007 Fall 2006 Fall 2006	~325
Marshall Steam Station Unit 2 Unit 3 Unit 4	Catawba	SNCR SCR SNCR	Spring 2007 Fall 2008 Fall 2006	~2,300
Total expected reduction = 3,275 tons/ozone season				

SNCR = Selective Non-Catalytic Reduction

SCR = Selective Catalytic Reduction

The combination of the mobile source and utility NO_x emission reductions that are expected in the Metrolina area after the end of the 2006 ozone season and before the beginning of the attainment year 2009 is significant. Since the 2004-2006 design values are just above the standard, the additional NO_x

emission reductions in the area should ensure that the Metrolina area will attain the NAAQS by the prescribed attainment year.

5. Local Measures Not Modeled

A significant source of NO_x emission reductions that has not been included in the modeling is the addition of a SCR unit at Marshall Unit 3. This SCR unit should be installed the fall of 2008 and will be operational before the beginning of 2009.

In addition to the Marshall NO_x emission reductions, the Metrolina area has a number of groups that are working towards decreasing emissions. These are voluntary measures that, although not accounting for large emission reductions, are reductions nonetheless. A few of the known measures that are under way in the Metrolina area include: I-77 High Occupancy Vehicle (HOV) lanes in Mecklenburg County, truckstop electrification in Rowan County, express bus routes, pedestrian walkway and bikeway projects, idle reduction policies, and biodiesel use and diesel retrofit projects. Discussions of these measures can be found in Appendix L.

D. Data Access

The modeling input and output files are very large and it would not be reasonable to submit all of these files with the SIP attainment demonstration. These include all files used to process the emissions, meteorology, and air quality models and any other files used to develop the modeling. To request access to these files, please contact the Bureau of Air Quality at 803-898-4123.

SECTION VI. MODERATE NONATTAINMENT AREA REQUIREMENTS

A. Clean Air Act (CAA), as amended (42 U.S.C. 7401, *et seq.*)

Sections 172(c), 182(a), and 182(b) of the CAA prescribe the requirements for ozone nonattainment areas. Any State with a designated nonattainment area must promulgate amendments to their SIP to address the requirements mandated by Section 172(c) of the CAA. As a Subpart 2, moderate ozone nonattainment area, the Metrolina area must meet the additional requirements prescribed by Section 182 of the CAA. Each State in which all or part of a Moderate Nonattainment Area is located shall make the submissions prescribed under Section 182(a) relating to Marginal Nonattainment Areas and shall also submit the revisions to the applicable implementation plan described under Section 182(b) with respect to Moderate Nonattainment Areas. The requirements are listed below, and SCDHEC's activities in promulgating amendments to the *South Carolina Air Quality Implementation Plan* (SIP) to comply with these mandates are discussed in more detail in the various parts of this section.

1. CAA Section 172(c) - Nonattainment Plan Provisions

Any State with a designated nonattainment area must promulgate amendments to its SIP to address the requirements mandated by Section 172(c) of the CAA. The SIP provisions (including plan items) required to be submitted under this part shall comply with each of the following:

(1) RACM - Implementation of all reasonably available control measures (RACM) as expeditiously as practicable [including such reductions in emissions from existing sources in the area as may be obtained through the adoption, at a minimum, of reasonably available control technology (RACT)] and provide for attainment of the national primary ambient air quality standards.

(2) RFP - Require reasonable further progress (RFP).

(3) Inventory - Include a comprehensive, accurate, current inventory of actual emissions from all sources of the relevant pollutant or pollutants in the nonattainment area, including such periodic revisions as USEPA may determine necessary to assure that the requirements are met.

(4) New Source Review (NSR): Identification and quantification - Identify and quantify the emissions, if any, of any such pollutant or pollutants that will be allowed from the construction and operation of major new or modified stationary sources in the nonattainment area. Demonstrate to the satisfaction of USEPA that the emissions quantified for this purpose will be consistent with the achievement of reasonable further progress and will not interfere with attainment of the applicable NAAQS by the applicable attainment date.

(5) Permits for new and modified major stationary sources - Require permits for the construction and operation of new or modified major stationary sources anywhere in the nonattainment area.

(6) Other measures - Include enforceable emission limitations, and other such control measures, means, techniques (including economic incentives such as fees, marketable permits, and auctions of emission rights), and schedules and timetables for compliance determined necessary or appropriate to provide for attainment of such standard in the nonattainment area by the applicable attainment date.

(7) Compliance with Section 110(a)(2) of the CAA.

(8) Equivalent techniques - Upon application by any State, USEPA may allow the use of equivalent modeling, emission inventory, and planning procedures unless USEPA determines that the proposed techniques are, in the aggregate, less effective than the methods specified by USEPA.

(9) Contingency measures - Provide for the implementation of specific measures to be undertaken if the area fails to make reasonable further progress or to attain the NAAQS by the applicable attainment date. Such measures shall be included in the plan revision as contingency measures to take effect in any such case without further action by the State or USEPA.

2. CAA Section 182 - Plan Submissions and Requirements

Each State in which all or part of a Moderate Nonattainment Area is located shall make the submissions prescribed under Section 182(a) relating to Marginal Nonattainment Areas and shall also submit the revisions to the SIP described under Section 182(b) with respect to Moderate Nonattainment Areas.

a. CAA Section 182(a) - Marginal Areas

Each State in which a nonattainment area is located shall submit to the USEPA the SIP revisions (including the plan items) described under Section 182(a) of the CAA.

(1) Inventory - Submit a comprehensive, accurate, current inventory of actual emissions from all sources.

(2) Corrections to the SIP - Submit a revision to the SIP that meets the following requirements:

(A) Reasonably available control technology (RACT) corrections - Submit, within 6 months of the date of classification, a revision that includes such provisions to correct requirements in (or add requirements to) the SIP concerning RACT.

(B) Motor vehicle inspection and maintenance (I/M) program.

(C) Permit programs - Provisions to require permits for the construction and operation of each new or modified major stationary source (with respect to ozone) to be located in the area.

(3) Periodic inventory

(A) General requirement - Submit a revised inventory every three years until the area is redesignated to attainment.

(B) Emissions statements - Require that the owner or operator of each stationary source of oxides of nitrogen or volatile organic compounds provide the State with an annual statement showing the actual emissions of oxides of nitrogen and volatile organic compounds from that source. The statement shall contain a certification that the information contained in the statement is accurate to the best knowledge of the individual certifying the statement. The State may waive the annual emissions inventory submittal requirement for any class or category of stationary sources that emit less than 25 tons per year of VOCs or NO_x.

b. CAA Section 182(b) - Moderate Areas

As a Subpart 2, moderate ozone nonattainment area, the Metrolina area must also meet the additional requirements prescribed by Section 182(b) of the CAA.

(1) RFP - Provide for volatile organic compound emission reductions, within 6 years, of at least 15 percent from baseline emissions, accounting for any growth in emissions. Provide for such specific annual reductions in emissions of VOCs and NO_x as necessary to attain the NAAQS for ozone.

(2) RACT - Require the implementation of reasonably available control technology with respect to all VOC sources in the area covered by any CTG issued by USEPA and all other major stationary sources of VOCs that are located in the area.

(3) Gasoline vapor recovery - Require all owners or operators of gasoline dispensing systems that sell more than 10,000 gallons of gasoline per month to install and operate a system for gasoline vapor recovery of emissions from the fueling of motor vehicles.

(4) Motor vehicle inspection and maintenance - Provide for a vehicle inspection and maintenance program.

(5) General offset requirement - The ratio of total emission reductions of VOCs to total increased emissions of such air pollutant shall be at least 1.15 to 1.

c. CAA Section 182(f) - NO_x Requirements

(1) The plan provisions required under this Subpart for major stationary sources of volatile organic compounds shall also apply to major stationary sources [as defined in Section 302 and Subsections (c), (d), and (e) of this Section] of oxides of nitrogen.

B. South Carolina Air Quality Implementation Plan (SIP) Provisions

1. RACM/RACT Requirements

Section 172(c)(1) of the CAA requires an amendment to the SIP to provide for the implementation of all reasonably available control measures (RACM) to demonstrate attainment as expeditiously as practicable [including such reductions in emissions from existing sources in the area as may be obtained through the adoption, at a minimum, of reasonably available control technology (RACT)] and provide for attainment of the national primary ambient air quality standards. Sensitivity analysis has demonstrated that VOC reductions have very little impact on ozone in South Carolina. SCDHEC has determined that the entire state is NO_x-limited and that the control program for reducing ozone should be focused on NO_x emission reductions. The overwhelming abundance of biogenic VOC emissions makes the majority of North and South Carolina, including the Metrolina area, a NO_x-limited environment for the formation of ozone.

a. RACM

In August of 2006, stakeholders involved in supporting South Carolina's "Cleaner Air Sooner" effort convened in Columbia to share and exchange ideas and information about their local strategies. It was appropriate that this "first of its kind" meeting was held in the state, since South Carolina, with forty-five of its forty-six counties participating, leads the nation in the number of local areas that are committed to implementing emission reduction measures. The EAC Summit was coordinated by SCDHEC staff with input from stakeholders for the purpose of offering the local leadership a stage to highlight their activities.

This sharing of ideas and local strategies served as an opportunity to connect EAC contacts and develop a network of peers for sharing information on positive strategies. To re-emphasize the importance of this work in South Carolina, USEPA Assistant Administrator Bill Wehrum addressed the attendees as the keynote speaker. Items on the agenda for the EAC Summit included: Energy Conservation; Diesel Retrofits; Land Use Planning; Alternative Fuels; Commuting Options; Innovative Education and Outreach; Health Impacts/Lifestyle; Finding the Funding; and Commuting Options (to Multi-Modal Transportation).

SEQL (Sustainable Environment for Quality of Life) is a special EPA Region 4 bi-state project involving the Charlotte-Mecklenburg area of North Carolina and the Catawba region of South Carolina, which includes Chester, Union, Lancaster, and York counties. The Centralina and Catawba Regional Councils of Government (COGs) have been instrumental in involving other local government organizations, state agencies and the public in SEQL. Due to these areas experiencing strong and sustained population growth, they face many challenges in maintaining good air quality and in contending with nonattainment for the eight-hour ozone NAAQS in some areas.

As part of SCDHEC's involvement in SEQL, the Bureau of Air Quality partnered with the Catawba Regional COG to develop model ordinances, examples of best management practices, and program guidance documents to assist local governments in implementing programs such as tree planting, bike trails, and parking with green spaces to address environmental concerns. The Model Ordinances are posted on SCDHEC's Web site as well as a link to the SEQL Web site. The Centralina and Catawba Regional COGs continue to work together to address air quality and other environmental concerns and are now developing a regional vision that will represent what residents, local jurisdictions, and private sector leaders want the region to be.

The following emission reduction measures impacting mobile sources are planned or have been implemented in York County:

- York County gas can exchange in 2004. Catawba Regional Council of Government (COG), Rock Hill Clean and Green, York County Government, City of Rock Hill, Palmetto State Clean Fuels Coalition, and Sustainable Environment for Quality of Life (SEQL) collaborated with SCDHEC on the event. A total of 110 old cans were turned in.
- South Carolina has two current school bus retrofit projects, a Santee Cooper Supplemental Environmental Project (SEP) project that involves installation of diesel particulate filters, and a Clean School Bus USA grant involving installations of diesel oxidation catalysts, crankcase ventilation systems, and anti-idling hardware. The nonattainment portion of York County is a priority area for both projects.
- Breathe Better anti-idling program is being implemented at Rosewood Elementary School in Rock Hill. Additionally, the Catawba Regional Council of Governments, the South Carolina Energy Office, and the Museum of York County have provided matching funds for a two-year implementation of this Idle Reduction Program in York County Schools through Congestion Mitigation and Air Quality (CMAQ) funding.
- Additional emission reducing projects to receive CMAQ funds include signal controller upgrades, intersection improvements, and bike/pedestrian projects.
- York Technical College has received a grant to retrofit nonroad equipment with diesel oxidation catalysts. The catalysts will be installed on 50 vehicles, including backhoes, bulldozers, motor graders, and others from the fleets of the City of Rock Hill, the South Carolina Department of Transportation, and Chester County.

- Where no transit has been available, Dial-a-Ride service will start in the City of Rock Hill (expanded from York County.)
- RFATS is participating in the Charlotte Region HOV lane study for I-77.
- A lawn mower exchange was held in York County in April 2007.
- RFATS is studying transit alternatives to connect downtown Rock Hill and Uptown Charlotte (Rock Hill-York County-Charlotte Transit Study.)
- Duke Energy launched a pilot program to subsidize public transportation costs for Charlotte area employees as part of the company's commitment to the environment and its ongoing efforts to help reduce ozone related emissions. Beginning September 1 and running through December 31 of 2006, the pilot program provided subsidies and incentives around bus transit, carpools and vanpools for full time and part time employees who work at the following Duke Energy locations: Catawba Nuclear Station (York, S.C.), Customer Contact Center (University Research Park), McGuire Nuclear Station (Huntersville, N.C.), and uptown Charlotte.
- EnviroFlash has been configured and activated for South Carolina's Catawba region. The Catawba region will include York, Chester, and Lancaster counties. By including York County in the Catawba region, SCDHEC will take over duties from North Carolina with regard to ground-level ozone forecasting for the county. SCDHEC believes that the resources in South Carolina are available to provide York County with an accurate and reliable forecast during the ground-level ozone season.

SCDHEC has initiated a program to continue the statewide focus on air quality that began with the Early Action Compact process. Staff are assigned to all counties of the state to work with local governments, businesses, and citizens to continue working to maintain and improve air quality. SCDHEC, with its York County partners, will continue to seek opportunities that offer emission reductions that may be needed to show maintenance of the 8-hour ozone standard.

b. RACT

In accordance with 40 CFR Part 51, Subpart X - §51.912 pertaining to moderate nonattainment areas under the 8-hour ozone NAAQS, the State is required to submit to the USEPA an amendment to the SIP that includes the identification and implementation of reasonably available control technology (RACT). The SIP amendment must meet the NO_x and VOC RACT requirements in Sections 172(c)(1), 182(a)(2)(A), 182(b)(2), and 182(f) of the CAA. The State must implement all reductions in emissions from existing sources in the nonattainment area as may be obtained through the adoption of RACT that will provide for attainment of the NAAQS as expeditiously as practicable. The CAA requires that RACT be applied to major stationary sources of NO_x and VOCs located in ozone nonattainment areas. A major source is considered any source with the potential to emit 100 tons per year or more of NO_x or VOCs.

As defined by USEPA in 40 CFR Section 51.100 - Definitions: Reasonably Available Control Technology (RACT) means devices, systems, process modifications, or other apparatus or techniques that are reasonably available taking into account (1) the necessity of imposing such controls in order to attain and maintain a national ambient air quality standard; (2) the social, environmental, and economic impact of such controls; and (3) alternative means of providing for attainment and maintenance of such standard.

RACT requirements are typically prescribed by State and local rules and regulations but may also be made on a case-by-case basis. In performing a RACT analysis, the State must look at available controls

to conclude whether they are reasonably available for a specific source or source category. RACT requires that sources adopt controls that are reasonably available, thus they may not be the most stringent controls that have been adopted for other similar sources. The fact that another similar source has such controls in place does not mean that such a control is reasonably available for all other similar sources.

SCDHEC has determined that there are no CTG (Control Technology Guidance) sources located within the nonattainment portion of York County. SCDHEC has identified three affected major non-CTG sources within the ozone nonattainment portion of York County subject to RACT requirements and has approached these facilities to conduct a RACT analysis:

- (1) Bowater, Inc. (Title V permit # 2440-0005);
- (2) Cytec Carbon Fibers, LLC (Title V permit # 2440-0097); and
- (3) Georgia Pacific Wood Products, LLC (Title V permit # 2440-0026).

The above facilities determined their RACT applicability based on "top down" procedures established for prevention of significant deterioration (PSD) and non-attainment new source review (NSR). A report of each facility's applicability determination that was prepared and submitted to SCDHEC for review is contained in Appendix Q. SCDHEC concurred with the reports' conclusions that installation of additional emission control devices would not be economically feasible, thus only work practice revisions will be utilized for RACT at these facilities. Georgia Pacific Wood Products, LLC, however, will comply with maximum achievable control technology (MACT) requirements in accordance with 40 CFR 63, Subpart DDDD, whereby MACT is at least as stringent as RACT.

Any new sources with the potential to emit 100 tons per year or more of NO_x or VOCs will be covered under the requirements of South Carolina Air Pollution Control Regulation R. 61-62.5, Standard No. 7.1, *Nonattainment New Source Review* (NSR).

2. Reasonable Further Progress

Section 182(b)(1) of the CAA mandates a 15 percent VOC emission reduction, accounting for growth, in the first 6 years after the baseline year (2002) for moderate and above ozone nonattainment areas. Thus, for the York County nonattainment area, a reasonable further progress (RFP) analysis between 2002 and 2008 is required.

The methodology SCDHEC used to calculate the RFP target levels of VOC emissions is based on the method developed in the CAA while taking into account the restrictions on creditable emissions and the need to use the 2002 inventory as a baseline. The CAA specifies four types of measures that are not creditable toward the 15 percent RFP requirement:

1. Any measure relating to motor vehicle exhaust or evaporative emissions promulgated by USEPA by January 1, 1990.
2. Regulations concerning Reid Vapor Pressure (RVP) promulgated after 1990 or required under Section 211(h) of the CAA.
3. Measures required under Section 182(a)(2)(A) of the CAA to correct deficiencies in the SIP regarding VOC RACT regulations required prior to enactment of the CAA Amendments of 1990.
4. State regulations submitted to correct deficiencies in existing or required I/M programs.

These four types of measures were all expected to result in a decrease in emissions between 1990

and 1996. Of these four types of measures, RACT and I/M program corrections did not apply to South Carolina because the State was in attainment for all standards at that time, and the 1990 RVP requirements were completely in place by 1996 and therefore are already accounted for in the 2002 baseline. As a result, they would produce no additional reductions between 2002 and 2008 or later milestone years.

However, the pre-1990 Federal Motor Vehicle Control Program (FMVCP) will continue to provide additional benefits during the first two decades of the 21st century as remaining vehicles meeting pre-1990 standards are removed from the vehicle fleet. Because these benefits are not creditable for RFP purposes, in order to calculate the target level of emissions for future RFP milestone years, SCDHEC first calculated the reductions that would occur over these future years as a result of the pre-1990 FMVCP. Consistent with the requirements of Sections 182(b)(1)(C) and (D) and 182(c)(2)(B) of the CAA, SCDHEC used the process described in Method 1 below to account for non-creditable reductions in calculating RFP targets for the 2008 milestone year. SCDHEC did not have VOC RACT regulations in the York County nonattainment area prior to the enactment of the 1990 CAA, thus only the on-road mobile source sector required an estimation of non-creditable emissions.

Method 1: For areas that must meet a 15 percent VOC reduction requirement by 2008:

(A) Estimate the actual anthropogenic base year VOC inventory in 2002 with all 2002 control programs in place for all sources.

(B) Using the same highway vehicle activity inputs used to calculate the actual 2002 inventory, run the appropriate motor vehicle emissions model for 2002 and for 2008 with all post-1990 CAA measures turned off. Any other local inputs for vehicle I/M programs should be set according to the program that was required to be in place in 1990. Fuel RVP should be set at 9.0 or 7.8 depending on the RVP required in the local area as a result of fuel RVP regulations promulgated in June, 1990.

(C) Calculate the difference between the 2002 and 2008 VOC emission factors calculated in Step B and multiply by 2002 vehicle miles traveled (VMT). The result is the VOC emissions reductions that will occur between 2002 and 2008 without the benefits of any post-1990 CAA measures. These are the non-creditable reductions that occur over this period.

(D) Subtract the non-creditable reductions calculated in Step C from the actual anthropogenic 2002 inventory estimated in Step A. This adjusted VOC inventory is the basis for calculating the target level of emissions in 2008.

(E) Reduce the adjusted VOC inventory calculated in Step D by 15 percent. The result is the target level of VOC emissions in 2008 in order to meet the 2008 RFP requirement. The actual projected 2008 inventory for all sources with all control measures in place, including projected 2008 growth in activity, must be at or lower than this target level of emissions.

The 2002 baseline VOC emissions for the York County nonattainment area are presented in Table VI-1.

Table VI-1: York County Nonattainment Area 2002 Baseline VOC Emissions (tons/day)					
	Point	Area	Nonroad	Highway Mobile	Total
York	7.29	7.48	3.19	6.84	24.80

The 2008 VOC emission estimates are included in Table VI-2.

Table VI-2: York County Nonattainment Area 2008 Projected VOC Emissions (tons/day)					
	Point	Area	Nonroad	Highway Mobile	Total
York	3.60	7.90	2.40	3.94	17.84

Table VI-3 provides the summary 15% RFP analysis showing the projected 2008 VOC emissions for the area, 17.84 tons/day, are well below the target level of emissions, 20.23 tons/day, as calculated using Method 1.

Table VI-3: York County Nonattainment Area 15% RFP Analysis		
York County 15% RFP Analysis	VOC (tons/day)	Step from Method 1
Total 2002 Base year anthropogenic VOC emissions	24.80	Step A
Non-creditable VOC reductions	1.00	Step C
2002 base year minus the non-creditable emissions	23.80	Step D
2008 target level of VOC emissions	20.23	Step E
2008 projected VOC emissions	17.84	Projection < Target RFP goal met

SCDHEC must show continued progress from 2008 through the attainment date (June 15, 2010). To do so, SCDHEC calculated the expected benefits from the fleet turnover for the on-road and off-road mobile sectors. In 2009 and 2010, SCDHEC expects approximately 0.73 tons per day of NO_x emissions reductions from this fleet turnover. SCDHEC did not calculate future expected VOC emissions reductions in 2009 and 2010 since the area is NO_x-limited, but additional VOC emission reductions are expected from the fleet turnover of the on-road mobile sector. SCDHEC believes these additional reductions demonstrate continued reasonable further progress toward attainment beyond 2008.

3. Actual Emissions Inventory

Section 182(a)(1) and Section 172(c)(3) of the CAA require the development of a comprehensive, accurate current inventory of actual emissions from all sources of VOC and NO_x in the nonattainment area. Such inventory was due two years after designation of the 8-hour ozone nonattainment areas, or by June 15, 2006. SCDHEC met this requirement through the submission of the 2002 emission inventories under the Consolidated Emission Reporting Rule (CERR) for that portion of York County within the nonattainment area. SCDHEC submitted statewide emissions inventories for point, area, nonroad mobile, and highway mobile sources.

The final 2002 emission inventories used in the attainment demonstration (found in "Appendix E - Emission Inventory Summary") will go through the public hearing process as part of the full attainment demonstration, which will include any updates or revisions that are necessary since the CERR submittal.

4. Emissions Inventory Statement

Section 182(a)(3)(B) requires the SIP to contain a requirement for all owners or operators of stationary sources located in the nonattainment area and emit either VOC or NO_x to submit a statement of actual emissions annually. The State may waive the requirement for sources that emit less than 25 tons per year of NO_x or VOC emissions.

5. Periodic Emissions Inventory

Section 172(c)(3) and 182(a)(3)(A) of the CAA require periodic inventory submissions. Specifically, Section 182(a)(3)(A) requires the inventory be submitted every three years until the area is redesignated to attainment. SCDHEC plans to meet this requirement through the CERR submittal. As such, SCDHEC will submit the 2005 emissions inventory on or before June 1, 2007.

6. Permit Program Requirements

It is required per Sections 172(c)(5) and 182(a)(2)(C) of the CAA that there be a permit program consistent with the requirements of Section 173. In addition, an offset requirement of 1.15 to 1 is required per Section 182(b)(5). SCDHEC submitted the regulations for the nonattainment new source review (NSR) contained in Regulation R. 61-62.5, Standard No. 7.1, *Nonattainment New Source Review* on July 1, 2005, to the USEPA for review and approval. These regulations adopted the new offset requirement. Furthermore, SCDHEC submitted amendments to Regulation R. 61-62.5, Standard No. 7, *Prevention of Significant Deterioration* (PSD) permitting regulations to the USEPA for approval on July 1, 2005. SCDHEC believes that the "prevention of significant deterioration" requirement of Section 110(a)(2)(D)(i) is met by the adoption and submittal of the NSR and PSD regulations since PSD and NSR are applicable to major sources in South Carolina. SCDHEC believes it has satisfied the permit program requirements for a moderate nonattainment area.

7. Gasoline Vapor Recovery

Section 182(b)(3) of the CAA requires moderate and above ozone nonattainment areas to implement Stage II vapor recovery programs. However, Section 202(a)(6) of the CAA states that the Section 182(b)(3) Stage II requirement shall not apply in moderate areas after onboard refueling vapor recovery (ORVR) rules are promulgated. USEPA promulgated the ORVR regulations on April 16, 1994. Therefore, 8-hour ozone moderate areas designated in 2004 are not subject to the Stage II vapor recovery program requirements. The attainment plan and contingency plan contained in this submittal addresses the necessary controls to attain the 8-hour standard in the Metrolina region.

8. Inspection and Maintenance Program

USEPA initially recommended the development of an On-Board Diagnostics (OBD) program for the Rock Hill-Fort Mill Area Transportation Study (RFATS) Metropolitan Planning Organization (MPO) portion of the Charlotte-Gastonia-Rock Hill, NC-SC moderate nonattainment area. SCDHEC examined the feasibility and impact of implementing an I/M program for the nonattainment portion of York County that would have affected only 55,700 vehicles. Emissions modeling indicated that an OBDII program, if implemented in the nonattainment area, would only reduce NO_x emissions by about 87 tons annually and volatile organic compounds emissions by about 63 tons annually, or approximately 49 tons and 37 tons, respectively, during the ozone season. SCDHEC approached several contractors to develop and implement an OBDII I/M program in the area but was unable to find a contractor who would undertake the expenses involved in running an I/M program of this size. SCDHEC found that it was not

economically feasible to proceed with implementation of an I/M program in South Carolina, and proceeded to petition EPA for a waiver of this moderate nonattainment area requirement.

Based upon correspondence between SCDHEC and USEPA Region 4 after their consultation with USEPA's Office of Transportation and Air Quality and the Office of General Counsel, USEPA concurred that the I/M requirement for moderate areas is not applicable to York County, SC. On November 23, 2005, USEPA Region 4 notified SCDHEC that the CAA requirement to implement an Inspection and Maintenance (I/M) program was not applicable to the York County, South Carolina RFATS MPO moderate nonattainment area. The correspondence from EPA Region 4 stated:

"Even though a portion of York County was designated as part of the Charlotte moderate 8-hour ozone nonattainment area, applicability of the I/M regulations to areas outside the Ozone Transport Region is based on the population of the urbanized area as defined by the 1990 census. As defined by the 1990 census (see enclosed map), the Rock Hill and Charlotte urbanized areas are distinct and are not contiguous. Although the Charlotte urbanized portion of the MSA is contiguous to the North Carolina/South Carolina border, it does not extend into South Carolina. The Rock Hill urbanized area is totally contained within South Carolina and does not touch the State line. Therefore, the applicability level of a 1990 census population of 200,000 or more in an urbanized area (40 CFR 51.350(a)(1)) applies to each of the two urbanized areas separately. Since the Rock Hill urbanized area has a population less than 200,000, the I/M requirement in Section 182(b)(4) of the CAA is not applicable to York County."

See "Appendix R - I/M Supporting Documents" for copies of the following correspondence between SCDHEC and EPA Region 4 relating to the I/M requirement for the nonattainment portion of York County.

October 26, 2004 (SCDHEC BAQ to EPA Region 4)

December 27, 2004 (EPA Region 4 to SCDHEC BAQ)

August 26, 2005 (SCDHEC to EPA Region 4)

October 3, 2005 (EPA Region 4 to SCDHEC)

November 23, 2005 (EPA Region 4 to SCDHEC)

"Appendix R - I/M Supporting Documents" also includes a copy of SCDHEC comments on the proposed rulemaking amendments to the vehicle I/M programs requirements to address the 8-hour NAAQS for Ozone dated February 7, 2005.

9. Other Measures

SCDHEC evaluated the expected emission reductions through the implementation of Federal and State programs and regulations. Many of the NO_x stationary point sources have already been or will be controlled upon implementation of the NO_x SIP call and CAIR SIP initiatives. In addition, the South Carolina Air Pollution Control Regulations and Standards has been amended with the addition of a new Regulation 61-62.5, Standard No. 5.2 - Control of Oxides of Nitrogen, and a revision of Regulation 61-62.2 - Prohibition of Open Burning, for additional control of NO_x emissions.

a. NO_x SIP Call

On October 27, 1998, the EPA finalized a Nitrogen Oxides (NO_x) State Implementation Plan (SIP)

Call Rule. The NO_x SIP Call was designed to reduce the regional transport of ground-level ozone through reductions in NO_x from electric generating unit (EGU) sources and from some non-EGU sources. The rule requires that, beginning in 2004, NO_x reductions must occur during ground-level ozone season in states whose NO_x emissions have been identified as contributing to 1-hour ozone standard non-attainment in "downwind" states. The rule also requires states to identify pollution-reduction measures and develop a plan to achieve these reductions.

A draft SIP revision was submitted to EPA on October 30, 2000. The SCDHEC Board (Board) granted initial approval on December 14, 2000. A public hearing was conducted before the Board on April 12, 2001, at which time the Board instructed staff to provide an additional 30-day comment period. A second notice of proposed regulations was published in the *State Register* on April 27, 2001. Final Board approval was granted on June 14, 2001. Legislative review was required and the final regulation was published in the *State Register* on May 24, 2002, as document number 2593. The draft SIP revision was submitted to EPA on July 30, 2001 for parallel processing. On April 10, 2002, EPA published the proposed approval of the plan in the *Federal Register* (67 FR 17317). Final EPA approval was published in the *Federal Register* on June 28, 2002.

Each state subject to the NO_x SIP Call regulation has a NO_x budget that the state allocates to applicable sources. The budget is NO_x based on cost-effective reductions in emissions that can be achieved by the affected sources. South Carolina's state trading program budget, as specified in Regulation 61-62.92, Nitrogen Oxides (NO_x) Budget Trading Program, is 19,678 tons. The NO_x SIP Call regulation will be repealed after 2009 upon implementation of the Clean Air Interstate Rule.

b. 8-hour Ozone Early Action Compact Regulations

On August 22, 2002, SCDHEC published a Notice of Drafting in the *State Register* announcing its intent to pursue Early Action Compacts (EAC) for the 8-hour ozone standard. Through the EAC process, local, state, and EPA officials committed to work together to develop and implement plans that will reduce ozone pollution so that areas are attaining the 8-hour ozone standard earlier than would be required by the Clean Air Act. Only areas that are attaining the 1-hour ozone standard are eligible to participate in the EAC process. The compact requires these areas to attain the 8-hour ozone standard by December 31, 2007, a date that is sooner than would otherwise be required through the traditional nonattainment designation process.

At the end of 2002, 45 of South Carolina's 46 counties, SCDHEC, and EPA Region 4 had signed compacts to implement ozone reduction strategies earlier than federally required. Statewide stakeholder groups involving local and federal governments, industry, environmental groups, and other interested parties have worked together to plan and implement strategies for ozone pollution prevention throughout the state. Plans involve mobile source pollution reduction, outreach actions, and point source prevention, which provide flexibility and foster local solutions to local problems. In 2002, York County elected to participate in the 8-hour Ozone EAC process. However, due to an area of York County (Rock Hill-Fort Mill Area Transportation Study Metropolitan Planning Organization, also known as RFATS MPO) being included in the Charlotte-Gastonia-Rock Hill, NC-SC nonattainment area, that portion of the county designated as nonattainment was no longer eligible to participate even though York County was designated attainment for the 1-hour ozone standard. York County officials have continued working with stakeholders to implement emission reduction measures and submit EAC progress reports every 6 months.

As part of this process, the EAC stakeholders developed statewide regulations aimed at achieving additional reductions in ozone precursors. One new regulation that was developed as part of this process was Regulation 61-62.5, Standard 5.2, Control of Oxides of Nitrogen (NO_x). This is a broad-based

regulation that applies statewide to new and existing stationary sources that emit NO_x from fuel combustion and have not undergone a best available control technology (BACT) analysis for NO_x. For new sources, the regulation requires the installation of control technology that is based on BACT standards found in the RACT/BACT/LAER clearinghouse. For existing sources, the regulation only applies when an applicable unit replaces its burner. At this point, they will be required to replace their burner with a low NO_x burner or equivalent technology capable of achieving a 30 percent reduction from uncontrolled levels.

Also, as part of the EAC process, Regulation 61-62.2, Prohibition of Open Burning, was revised by deleting the exception for the burning of household trash, revising the exception for the burning of construction waste, and revising the exception for fires set for the purpose of firefighter training. The burning of household trash presents health and environmental concerns for many communities. The smoke generated from these activities is a nuisance to some and a health threat to others with asthma or other respiratory problems. With respect to the exception for the burning of construction waste, the regulation was revised to allow only residential construction waste to be burned outside the ozone season, and this will only be allowed if it meets the provisions of the regulation. Finally, the exception for the purpose of firefighter training was revised to ensure that minimum health, environmental, and safety concerns are addressed.

These regulations were approved by the Board in January 2004, and, in accordance with South Carolina law, they were subsequently submitted to the Legislature for approval. The South Carolina General Assembly approved the regulations, and the rules were published and became effective upon publication in the *State Register* on June 25, 2004. Statewide NO_x reductions from the Control of NO_x regulation are estimated at 3,357 tons a year. Statewide reductions resulting from the revisions to the Prohibition of Open Burning regulation are estimated at 147 tons of NO_x and 698 tons of VOC per ozone season.

c. Clean Air Interstate Rule

On March 10, 2005 the EPA finalized the Clean Air Interstate Rule, also referred to as CAIR. On May 12, 2005, CAIR was published in the *Federal Register*.

CAIR affects 28 states and the District of Columbia, whose emissions of sulfur dioxide (SO₂) and/or NO_x produced by EGU sources and some non-EGU sources contribute significantly to the nonattainment of the National Ambient Air Quality Standards (NAAQS) for fine particles (PM_{2.5}) and/or 8-hour ozone in downwind states. (SO₂ and NO_x are both precursors to ground-level ozone formation, and NO_x is also a precursor to PM_{2.5} formation.) The EPA has determined that EGU sources in South Carolina are affecting the nonattainment of ozone and PM_{2.5} standards in downwind states. CAIR is a cap-and-trade program for NO_x and SO₂ emissions from affected facilities and has two phases of implementation:

Phase I which begins in 2009 for NO_x (annual and ozone season) and 2010 for SO₂; and

Phase II which begins in 2015 for both pollutants.

CAIR was due for submission to the EPA for approval on September 11, 2006. South Carolina is one of many states that did not meet this deadline because of a lengthy regulatory process. SCDHEC is working closely with EPA Region 4 toward implementation of the State's rule. SCDHEC has adopted the federal CAIR with modifications in areas where the state has flexibility. A Notice of Drafting was published in the *State Register* on July 22, 2005; a second Notice of Drafting was published in the *State Register* on February 24, 2006. The initial approval to proceed with the proposed regulation was given by the SCDHEC Board on September 14, 2006. The Notice of Proposed Rule was first published in the

State Register on October 27, 2006. A public hearing before the SCDHEC Board was held on January 11, 2007. On January 22, 2007, the proposed regulation was submitted to the South Carolina Legislature for approval. In March of 2007, SCDHEC submitted a request to EPA Region 4 for parallel processing. SCDHEC anticipates the proposed regulation to become state-effective upon publication in the *State Register* in mid-Summer 2007. South Carolina is working with USEPA to complete the parallel processing at this time.

d. Regulation R. 61.62.2, *Prohibition of Open Burning*

On June 24, 2004, the Department revised its existing regulation regarding open burning activities to reduce emissions of ozone precursor pollutants. Among the revisions were elimination of the exception for burning household trash, modification of the exception of burning of construction waste, and modification to the exception for fires set for firefighter training. Based on the Department's 1999 emissions inventory, residential burning of household waste generates 2,379 tons of NO_x and 11,896 tons of VOCs in the state annually. As for the ban on the burning of construction waste, the data indicates that the ban on residential construction waste alone will result in annual reductions of 147 tons of NO_x and 625 tons of PM. Information on the amount of reductions to be expected from the ban on the burning of commercial construction waste is not available, but it is clear that substantial reductions in NO_x and VOCs will occur statewide starting in 2004 as a direct result of the elimination of this activity as well.

Regarding the burning of construction waste, the Department revised this provision to allow only *residential* construction waste to be burned and only under the following conditions: the burning must take place outside of ozone season (not during April 1 through October 30 in South Carolina), the burning must be conducted at least 500 feet from any occupied structure, and the burning must be only of "clean" waste. Further, the exception for the purpose of firefighter training has been revised to ensure that minimum health, environmental and safety concerns are addressed. The Department intends to do a review of permanent firefighter training facilities and will evaluate nonpermanent sites and require Department approval prior to a burn. Finally, in accordance with South Carolina Air Pollution Control Regulation 61-62.2, Section II.C., the Department reserves the right to restrict open burning on forecasted code orange and higher air quality ozone action days for York County.

e. Regulation R. 61-62.5, Standard 5.2, *Control of Oxides of Nitrogen*

On June 24, 2004, South Carolina adopted Air Pollution Control Regulation R.61-62.5, Standard No. 5.2, *Control of Oxides of Nitrogen* to ensure areas attain and maintain the 8-hour ozone standard. This regulation requires Best Available Control Technology (BACT)-level controls on all stationary sources that emits or have the potential to emit NO_x. Many of these sources would not otherwise be required to control their NO_x emissions. For example, under the Clean Air Act requirements, the preconstruction review program referred to as New Source Review (NSR) only applies to larger sources (generally those with potential emissions greater than 100 tons per year or more). For sources with emissions below these levels, there are generally no controls for NO_x required.

This newly-developed regulation applies state-wide to new and existing stationary sources of NO_x emissions. Larger sources that have undergone a BACT review for NO_x are exempt from the regulation; however, larger sources that have taken limits to opt out of a Prevention for Significant Deterioration (PSD) review will still be required to comply with this regulation which covers sources ranging from boilers and turbines to fluidized bed combustors and lime kilns. For existing sources, the regulation only applies when an applicable unit replaces their burner. At this point, they will be required to replace their burner with a low burner or equivalent technology capable of achieving a 30% reduction from uncontrolled levels.

10. Compliance with Section 110(a)(2)

Section 172(c)(7) requires nonattainment SIPs to meet the applicable provisions of Section 110(a)(2). The NCDAQ and SCDHEC - BAQ have reviewed the requirements of Section 110(a)(2) and have concluded that the prior rule submittals, along with this attainment demonstration plan, address the relevant requirements.

11. Equivalent Techniques

SCDHEC believes that the procedures for modeling, emissions inventory and planning follow USEPA guidance and is not requesting approval for equivalent techniques, as allowed under Section 172(c)(8) of the CAA.

12. Contingency Measures

Section 172(c)(9) requires that the nonattainment SIPs contain specific measures that would take effect upon a State's failure to attain the ozone standard in a given area, without further action by the State or USEPA. Guidance from USEPA indicates that the measures should be approximately three percent of the baseline emissions, so that reasonable progress level of reduction could be expected to occur in the year following the failure to attain. SCDHEC elected to adopt NO_x-only contingency measures since the area is NO_x-limited. The contingency plan consists of Federal and State measures. The Federal measures result from the fleet turnover of the light and heavy-duty engine standards from the on-road mobile sector and the nonroad engine standards. These measures are already adopted and the fleet turnover will occur without further action by either the State or USEPA. The fleet turnover will result in approximately 0.11 tons/day NO_x emission reductions, or about 2.2% of the base emissions. The analysis of these emission reductions is included in Appendix P.

The State anticipates additional reductions from local measures implemented by the Rock Hill-Fort Mill Area Transportation Study (RFATS) Metropolitan Planning Organization (MPO). SC has been determined to be NO_x limited, SCDHEC will encourage the RFATS Interagency Partners to fund future CMAQ projects that will result in the most reduced NO_x emissions. There is no easy way to estimate the amount of reductions that would be achieved through Congestion Mitigation and Air Quality (CMAQ) projects.

SECTION VII. MOTOR VEHICLE EMISSION BUDGET

A. Transportation Conformity

The purpose of transportation conformity is to ensure that Federal transportation actions occurring in nonattainment and maintenance areas do not hinder the area from attaining and maintaining the 8-hour ozone standard. The level of emissions estimated by the Rock Hill-Fort Mill Area Transportation Study Metropolitan Planning Organization (also known as RFATS) for the Transportation Implementation Plan (TIP) and Long Range Transportation Plan (LRTP) must not exceed the motor vehicle emission budget (MVEB) as defined in this attainment demonstration.

1. Memorandum of Agreement

On September 27, 1996, a Memorandum of Agreement (MOA), negotiated between the South Carolina Department of Health and Environmental Control (SCDHEC) and the South Carolina Department of Transportation (SCDOT), was published in the *South Carolina State Register*. The purpose of the MOA was to formally incorporate the applicable provisions of the transportation conformity review process in accordance with the requirements of the CAA as promulgated by the United States Environmental Protection Agency (USEPA) on November 24, 1993 (58 FR 62188) in 40 CFR Part 51 Subpart T, as amended August 7, 1995 (60 FR 40098), and November 14, 1995 (60 FR 57179). Under those authorities, no department, agency, or instrumentality of the Federal government shall engage in, support in any way or provide financial assistance for, license or permit, or approve any activity that does not conform to the *South Carolina Air Quality Implementation Plan* (SIP). The transportation conformity rule requires Federal agencies to determine, prior to taking any action on transportation plans, programs, and projects, that such action will conform to the SIP to maintain the National Ambient Air Quality Standards (NAAQS). The transportation conformity regulation applies only to areas that are designated nonattainment or maintenance for any of the criteria pollutants (ozone, carbon monoxide, fine particulate matter, sulfur dioxide, nitrogen dioxide, or lead).

On August 15, 1997 (62 FR 43780), April 10, 2000 (65 FR 18911), and August 6, 2002 (67 FR 50808), USEPA promulgated amendments to the transportation conformity rule to streamline and clarify the criteria and procedures for determining the conformity of transportation plans, programs, and projects. The State was required by 40 CFR Part 51 Subpart T Section 51.390 to amend the SIP by specifically removing any previously applicable implementation plan transportation conformity requirements and submitting a revision to the SIP that addresses all requirements of 40 CFR Part 93 Subpart A. A Notice of General Public Interest was published on August 25, 2000. This SIP revision was delayed by the time-consuming task of gathering the necessary signatures for a MOA. A staff-conducted public hearing was held on the proposed revision on September 22, 2003. The SIP amendment was published as final in the *State Register* on October 24, 2003, and subsequently submitted to EPA for final approval on November 14, 2003. EPA published approval of the SIP revision in the *Federal Register* (69 FR 4245) on January 29, 2004.

In accordance with these requirements, SCDHEC incorporated into the SIP a new MOA to implement Section 176 of the Clean Air Act (CAA), as amended (42 U.S.C. 7401, *et seq.*), the related requirements of 23 U.S.C. 109(j), and regulations under 40 Code of Federal Regulations (CFR) Part 93, Subpart A. The parties to this MOA are as follows: each of the South Carolina Metropolitan Planning Organizations (MPOs), SCDHEC, SCDOT, Federal Highway Administration South Carolina Division Office (FHWA), the Federal Transit Administration (FTA), EPA Region 4 (USEPA), and local publicly-owned transit agencies not represented by aforementioned MPOs in non-attainment and maintenance areas. The “South Carolina Criteria and Interagency Consultation Procedures for the Determination of the Conformity of Transportation Plans, Programs, and Projects” provides for interagency consultation,

resolution of conflicts, and public consultation procedures. The parties to this MOA agreed to conduct transportation conformity determinations in accordance with the provisions of 40 CFR Part 93 Subpart A.

The SIP amendment consisted of the following documents:

- 1: South Carolina Transportation Conformity Memorandum of Agreement as endorsed by all parties.
- 2: South Carolina *State Register* “Notice of Amendment to the South Carolina Air Quality Implementation Plan” - Published on October 24, 2003.
- 3: Notice of Public Hearing published in the *State Register* on August 22, 2003.
- 4: Copy of the verbatim transcript of the September 22, 2003, Public Hearing.
- 5: South Carolina’s Legal Authority (Excerpt from the USEPA-approved SIP).

2. Conformity Interagency Consultation - York County/RFATS MPO

On April 15, 2004, USEPA issued designations and classifications based on the severity of the 8-hour ozone NAAQS in each state with an effective date of June 15, 2004. This included the RFATS MPO boundary for the York County area along with contiguous portions of North Carolina. In making the boundary and classification determinations, USEPA utilized 8-hour ozone monitoring data from the 2001-2003 calendar years. Although the monitor in York County during that time was below the 8-hour ozone standard of 0.085 parts per million (ppm), USEPA determined that a portion of York County contributed to violating monitors in nearby North Carolina. The nonattainment area was classified under Subpart 2 of the Clean Air Act as being a “moderate” nonattainment area for ozone. This was decided based upon a monitored ozone value of 0.100 ppm in Rowan County, North Carolina.

As a minimum requirement, no later than June 15, 2005, the RFATS area was required to demonstrate transportation conformity to ensure that all projects utilizing federal funds do not have an adverse impact on the area’s air quality. Transportation Conformity consultation procedures as outlined in the South Carolina Transportation Conformity Memorandum of Agreement and endorsed by all parties enabled the nonattainment area to immediately begin the process. The York County Interagency Consultation process, which included representatives from York County, RFATS, SCDHEC, SC Department of Transportation, USEPA Region 4, SC Division Office of Federal Highways, the Federal Transit Authority, City of Rock Hill, and York County, was initiated on May 14, 2004, and is ongoing. Specific information regarding this process is included in Appendix F3 Section 4.1.

3. RFATS - CMAQ Projects

The Congestion Mitigation and Air Quality Improvement Program (CMAQ) was created by the Intermodal Surface Transportation Equity Act (ISTEA) in 1991, was reauthorized by the Transportation Equity Act for the Twenty-First Century (TEA-21), and was subsequently reauthorized by the Safe Accountable, Flexible Efficient Transportation Equity Act - a Legacy for Users (SAFETEA-LU). The CMAQ program provides funding for projects designed to help achieve and maintain the NAAQS. South Carolina receives an annual minimum apportionment, which in 2006 was a little over \$10 million. A mandatory portion of that, nearly \$2 million, was required to be used in the Rock Hill nonattainment area. To be eligible for the mandatory funding, projects must advance air quality goals. New roads or lanes that would potentially increase traffic are not eligible for CMAQ funding. A variety of eligible project types include traffic control signalization, traffic flow improvements, alternative fuel programs, transit

projects, carpooling programs, and bicycle and pedestrian projects.

The RFATS MPO announced its approved list of CMAQ projects for the funding years 2004 through 2006 at a press conference on January 26, 2007. The York County interagency consultation group, which includes the RFATS MPO, SCDHEC, SCDOT, USEPA Region 4, the FHWA, and the FTA, has been meeting for several years to address transportation conformity and the attainment SIP. This group approved the methodology used in determining air quality benefits for the selected projects. All RFATS-sponsored CMAQ projects are included in the RFATS 2030 Long Range Transportation Plan. The project list includes signalization improvements, turn lanes, bicycle paths, a hybrid trolley, alternative fuel vehicles, and an idle reduction and awareness program for schools. Of the ten projects on the list, seven are fully-funded. Project sponsors include the City of Rock Hill, RFATS, RFATS Congestion Management System, SCDOT District 4, York County, and the Catawba Regional Council of Governments (COG). Local matches were provided by the City of York, the City of Rock Hill, York County, the Catawba COG, the SC Energy Office, the Rock Hill School District, and the Museum of York County. Emissions reductions over the lifetimes of the currently-funded projects are estimated at 1,999 tons of VOCs, 8,659 tons of CO, and 1,678 tons of NO_x. Matching funding for the three additional projects will need to be identified before they can proceed. These projects, when funded, will produce additional reductions of 61 tons of VOCs, 266 tons of CO, and 52 tons of NO_x.

B. Highway Mobile Source VOC Insignificance

Section 93.109(k), in the Transportation Conformity Rule Amendments for the new 8-hour ozone and fine particulate matter NAAQS, addresses areas with insignificant motor vehicle emissions. The rule suggests that such a finding would be based on a number of factors, including the percentage of motor vehicle emissions in the context of the total SIP inventory, the current state of air quality as determined by monitoring data for that NAAQS, the absence of SIP motor vehicle control measures, and historical trends and future projections of the growth of motor vehicle emissions. Although there is a vehicle control measure (inspection and maintenance) program in place in the North Carolina counties of the Metrolina area, it was established for additional reductions in NO_x emissions. There are incidental VOC emissions reductions as a result of this program; however, it is not believed the reduction of VOC emissions has resulted in decreased ozone levels.

SCDHEC has examined NCDAQ's study to determine sources of VOC emissions and their contribution to ozone formation in the Metrolina area. Due to the generally warm and moist climate of the Carolinas, vegetation abounds in many forms, and forested lands naturally cover much of each state. NCDAQ has found that, as a result, the biogenic sector is the most abundant source of VOC emissions in the Carolinas, accounting for approximately 90% of the total VOC emissions. The overwhelming abundance of biogenic VOC emissions makes the majority of North and South Carolina, including the Metrolina area, a NO_x-limited environment for the formation of ozone.

Additionally, SCDHEC has reviewed a number of modeling sensitivity runs performed by NCDAQ that were designed to determine the impact of highway mobile source VOCs on ozone formation in the Metrolina area. The results of these sensitivities indicate no change in future ozone concentrations in the Metrolina area when highway mobile VOC emissions are significantly changed (e.g., 50% decrease). These sensitivities are discussed in more detail in Appendix F.3.

SCDHEC agrees with NCDAQ findings that highway mobile VOCs are insignificant contributors to ozone formation in the Metrolina nonattainment area. Emission estimates indicate highway mobile VOC is a small percentage of the total VOC emissions inventory. Highway mobile VOC emissions are projected to decrease in the future, notwithstanding VMT increases. Emission sensitivity modeling indicates no change in future ozone concentrations when VOC emissions are significantly changed. For

these reasons, neither NCDAQ nor SCDHEC will be setting MVEB for VOC for the Metrolina nonattainment area. SCDHEC consulted with its interagency transportation partners prior to reaching this conclusion. Both agencies will revisit the setting of MVEB for VOC if there is any future indication that the Metrolina area has become VOC-sensitive for ozone formation.

As a result of the finding of VOC insignificance, SCDHEC will not be establishing a VOC budget for the 2008 Reasonable Further Progress determination nor the 2009 attainment demonstration.

C. Motor Vehicle Emission Budgets

The MVEB will be set for the attainment year 2009. By the time the MVEB is approved by USEPA, the next transportation conformity regional emissions analysis should be for years 2009 and beyond. Therefore, an MVEB will not be set for the baseline year 2002.

Although emissions are usually expressed in terms of tons per day, the MVEBs will be set in terms of kilograms (kg) per day. The reason for the change is because the MOBILE model generates emission factors in grams per mile. In past conformity exercises, there have been some issues with conversion to tons per day, as well as concerns with how MVEBs were rounded to the hundredth place. Setting the MVEB in kilograms per day will avoid these issues in future conformity determinations. During the development of the MVEB, the interagency partners for the York County nonattainment area were consulted.

Table VII-1 shows the York County on-road mobile NO_x emissions expressed in tons per day and the corresponding kilograms per day values for 2009.

Table VII-1: 2009 Highway Mobile Source NO_x Emissions York County Nonattainment Area		
County	2009	
	Tons/day	Kg/day
York (partial)	8.01	7,266

Upon USEPA's affirmative adequacy finding for the partial county MVEB, as shown in Table VII-2, it will become the applicable MVEB for the nonattainment portion of York County.

Table VII-2: York County South Carolina NO_x MVEB for 2009	
County	MVEB (Kilograms/day)
York (partial)	7,266